VOLVME IIII MARCH 1895 NO·3

THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

BRICK AND MARBLE IN THE MIDDLE AGES.

G. EDMUND STREET.

CHAPTER VIII.

(*Continued.*)

THERE is another respect in which St. Mark's is extremely Eastern. This is in the almost entire absence of figure sculpture in its original construction. The subjects and figures on the columns of the baldachin are too delicate to be noticed from a distance, and it was not until A. D. 1394 that the choir screen was introduced with figures of the apostles on either side of the rood, erected no doubt to supply a want which had been long felt before it was gratified. At the same time figures were added in niches between the gables of the exterior, but even now they form a small and inconsiderable part of the decoration of the church.

I have lingered on paper as I did in reality about St. Mark's; but if we wish to see Venice, we must tear ourselves away from it. We will go out by the baptistery, and here we are at once on the Piazzetta, the noble façade of the Ducal Palace on one side, and a great work of Sansovino's — the library of St. Mark — on the other; at the end of the Piazzetta are two monolithic granite columns, one of which bears the lion of St. Mark, the other the figure of the ancient patron saint of Venice, St. Theodore; between them is seen the dark blue line of the sea rippled into a thousand twinkling waves, and beyond this the Isola San Giorgio, remarkable for one of Palladio's churches,— a building, as I think, irredeemably ugly, but, nevertheless, much admired by many. If you walk down to the strand, where a hundred gondolas wait for hire,— some black and funereal-like, others dressed up with gay awnings, and all of them proud and swan-like with their bright steel prows rising lightly and high out of the water, — and then, turning round, look first down the Riva dei Schiavoni towards the sea, taking in the long sea front of the Ducal Palace, then the narrow gap bridged by the famous Bridge of Sighs, and on again, noting bridge after bridge, and the Gothic palace now turned into the Hotel Danieli, and then on to the promontory running out towards the Adriatic, occupied by the Public Gardens and planted with the only trees that Venice boasts, how lovely is the scene! or if, looking back up the Piazzetta to St. Mark's, noting the tall campanile and the quaint clock and clock tower beyond, and the domes and turrets, niches and figures, which crown the church, how much more vividly does it not impress the mind!

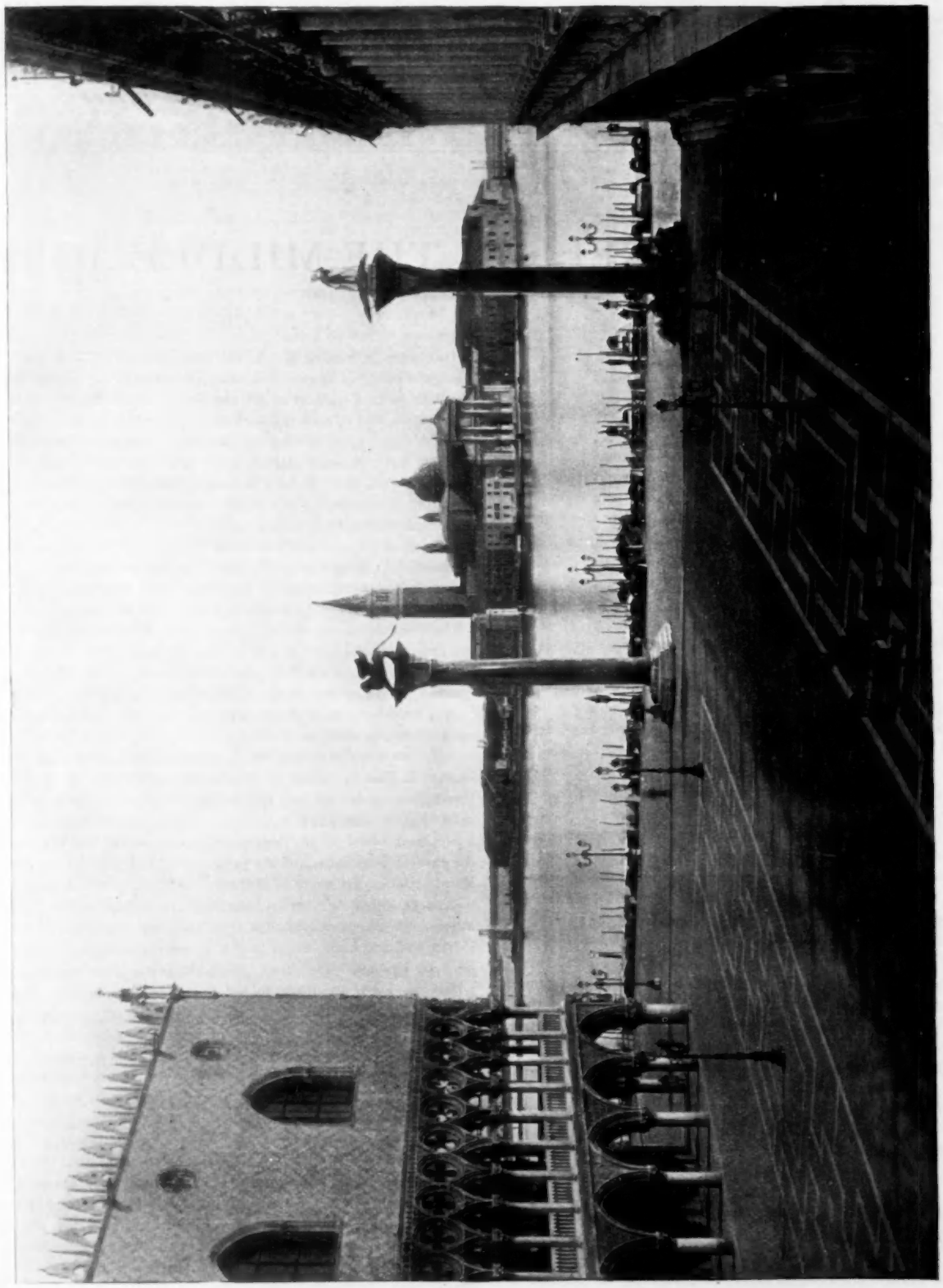
Venice is full to excess of striking pictures, and it would be endless to say in how very many respects it has a character of its own which can never be forgotten. The strange silence of its watery streets, broken only by the cry of the gondolier or the delicate plash of his oar in the water, is not the least impressive thing to the stranger; and when, after trying in vain to thread on foot the labyrinth of passages which confuse him irrecoverably in a few minutes, he commits himself to the dark recesses of a gondola, how delightful is the quiet, smooth, and yet rapid way in which, without more labor than is necessary in looking about, he finds himself now following the narrow winding of some small canal, awakening the echoes between the high walls of palaces or warehouses on either side of the way, or anon, upon turning with a graceful sweep into the smooth broad reach of the Grand Canal, making his gondolier move gently and slowly, as one by one the great palaces which grace its banks and form its retaining walls are carefully scanned, whilst the various and ever-changing perspective of the whole is dwelt upon, to be remembered afterwards with such intense pleasure!

From St. Mark's I remember trying to find my way to San Stefano, and taking a map of Venice, and calculating upon the orientation of the churches being fairly correct, I flattered myself that I might, without difficulty, make my way: the result was simply that for half an hour I was threading the mazes of all the passages around the church, and at last reached it only by chance; and I found afterwards that it would not at all do to take the churches as marking the cardinal points of the compass, for, as may be seen from the campanile of St. Mark, there are scarcely two churches in the city exactly alike in their orientation.

But pleasant as it is to recall one's recollections of highways and byways in Venice, I think if we wish to understand her architecture thoroughly we shall do well first of all to make a pilgrimage to Torcello, that sad and weird cathedral, standing forlorn and deserted on a wretched island in the lagoon, wherein we see the handiwork of the earliest Venetians, and the prototype of much of the later work in Venice itself. The story of Torcello has been told often, by no one with more feeling or more pathos than by Mr. Ruskin, and I need not attempt to repeat it. Suffice it to say that about A. D. 641 the church was first built, whilst in 864 it was restored; and being nearly decayed by age, was again most studiously repaired in 1008;[1] whilst in 1361, according to the testimony of Cornaro,[2] there was still standing on the same island divers churches (forty-two in number) adorned with columns of *pietra dura*, and with mosaics. Strange indeed is the difference here between then and now!

My first visit to Torcello was sad and sombre enough, to begin with. We started early from Venice in a thick mist, making our way first to the cemetery, where there is a good tall campanile, then to Murano, and through its shabby water streets passing the end of San Donato (which shall be described later), and then on through long canals, edged on either side by miles of green mud, and thronged with market boats and noisy boatmen. Here and there across the lagoon we saw a tall campanile marking the position of each settlement or island in this waste of sea and mud, and last of all that of the cathedral of Torcello, some five minutes' walk among decaying walls and unmown grass, from the half-ruined landing place to which our gondolier tied his boat. All that remains of the city is

[1] Sagornino Chronicon, p. 119.
[2] Il Palazzo Ducale di Venezia, per Francesco Zanotto, I. p. 9.



PIAZZETTA AND SAN GIORGIO, VENICE.

SUPPLEMENTARY ILLUSTRATION TO "BRICK AND MARBLE IN THE MIDDLE AGES."

before us in small compass. On the left a fourteenth-century building, said to have been the Palazzo Publico; in front, a stone seat or throne in the centre of what was once the market place; on the right, the Byzantine church of Sta. Fosca; and beyond, and connected with Sta. Fosca by a cloister, the modernized-looking cathedral, plain, bare, and uninteresting on the outside, with a detached campanile near the east end. This is all Torcello has to show; but forlorn and decayed as everything in the place is, it is precious in the highest degree to the architect who cares about the growth of his art. The cathedral is full of interest, though much damaged by extensive repairs, carried on in a reckless mood by the Austrians, not long before they lost Venetia, when new roofs were put on, and the mosaics were so much damaged that I remember collecting a handful of fragments from a barrow of rubbish before it was shot into the canal; at the same time a scaffold was erected for a proposed restoration of the great western mosaic, which, though threatened and indeed commenced in 1857, had not, in 1872, been proceeded with. The exterior has been completely modernized. In plan the cathedral consists of three parallel naves of ten bays, all finished with apses. The columns dividing the nave from the aisles are of veined marble, with capitals of exquisite workmanship, founded, indeed, on Corinthian examples, but modified by Byzantine influence and by study of nature. The arches are stilted and high; above them is a small clerestory of very simple windows. The central apse retains its raised rows of seats, though their brickwork alone is left; the throne for the bishop is placed in the centre, and retains some of its marble inlay. Under this raised east end a descending passage is formed, connecting the two smaller apses, and with a small apse formed in the thickness of the east wall opening into it. Three bays of the church are given to the choir, which is fenced round with richly sculptured marble screens. On the west the screen has marble columns, carrying a flat entablature, and below them is a solid portion some four feet high, covered with panels of flat sculpture, one having two peacocks drinking out of the same vase; another, two lions at the foot of a branching tree; and another, a complicated interlacing pattern of foliage. Such a screen is the obvious prototype of that in St. Mark's, and the sculptures with which it is adorned are evidently the work of some early Byzantine workman; whether brought from Aquileja from the ruins created by Attila's invasion, or wrought on the spot, I cannot say, but of a character which we still see in some of the nearly corresponding screens in the existing cathedral of Aquileja. Northwest of this rood-screen stands the marble *ambon*, a pulpit of two divisions, one (circular) facing south, the other (square) facing west. This and the staircase leading to it are full of delicate and good carved work. The arrangement has an absurd likeness to many a modern English scheme of pulpit and reading pew, and there is certainly force in an observation which Mr. Webb makes,[1] that such an arrangement would never have been thought of unless the gospel was to be understood by the people. Now they do not understand it; it is no longer said from an *ambon*, and *ambons* seem to be much less useful to Romans than rood-screens are to us!

INTERIOR OF THE DUOMO AT TORCELLO.

The screens north and south of the choir do not seem to be so old as the other, and are simple low screens.

In the mosaics of the apse and western wall we have, perhaps, the finest examples of Venetian mosaics. The apse is lined with slabs of veined marble below, and has above a mosaic of the Blessed Virgin Mary with our Lord and the twelve apostles, and the patron of the church, St. Heliodorus. The whole west hall is covered with a grand mosaic of the Crucifixion at the top, the Descent into Hell under it, and a Last Judgment at the base, which is carried down on each side of the west door, in the tympanum of which is a half figure of Our Lady. A mosaic at the end of the south aisle has our Lord with SS. Michael and Gabriel, and below them St. Gregory, St. Martin, St. Ambrose, and St. Austin.[2] Save where these mosaics occur, the walls have been persistently whitewashed, so that the appearance of the church is now far from attractive. It is not the less of great interest, as an example of a very early church founded on a Roman basilica, but with Byzantine influence most conspicuous in the sculpture of its ornaments.

Here, as in St. Mark's, the floor is paved with opus Alexandrinum, of which, in spite of damage done during the late repairs, it is a fine example. There is nothing to admire on the exterior, though the large stone shutters to the windows — single slabs of stone about four inches thick, working on stone pivots — have a most primitive air. The campanile has not much to distinguish it from others, but the top affords an interesting view of the lagoon and the sea with Venice in the distance, and the Alps of Friuli far away to the north.

A few yards through the cloister bring us to the church of Sta. Fosca. Here by the side of the Romanesque we have a capital example of a Byzantine plan, which seems to me to be of the greatest value in connection with the whole of the round-arched palaces of Venice, of which so many remains still exist. Sta. Fosca is a square church with small projections on the north, south, and west sides, and a deeper projection for the altar on the east. There are three eastern apses, and the western side is screened by an open cloister, which is octagnol in plan. The square centre is domed on very simple pendentives, and the capitals are similar in character to those in the cathedral. The best detail is to be seen outside the east end, where there is some good arcading and an enriched band of chevron ornament, formed by recessing the brickwork, and a mixture of red and buff brickwork which is very effective.

(*To be continued.*)

[1] Continental Ecclesiology, p. 306.

[2] The mosaics here, as in Venice, are wholly of glass. The gold is covered with a thin film of glass, and the other colors used are dead white, black, dark and light blue, green, and red. The very smallness of the palette was here, just as it was with the old painters on glass, a distinct advantage, saving them from the bizarre and confused effect produced in such works by the use of too many colors or shades of colors.

THE ART OF BUILDING
AMONG THE ROMANS.

Translated from the French of Auguste Choisy by Arthur J. Dillon.

CHAPTER II. — *Continued.*

CIRCULAR VAULTS. — *Continued.*

THE dome of the edifice which is called by the very doubtful name of "Minerva Medica" is a vault conceived in the same way, but one which contrasts strangely with the preceding one by its rude construction. I give in Plate XI. a partial view of the monument, and in Fig. 47 plans of the vault which are sufficient to show all its irregularity.

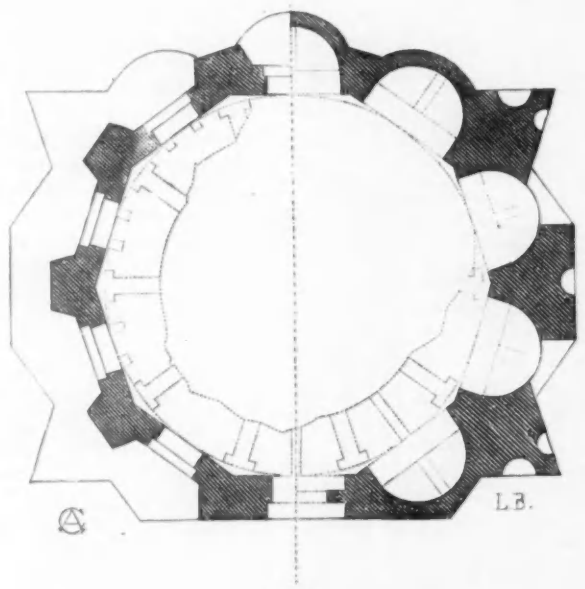


Fig. 47.

As long as one confines himself to the general conditions, the idea of the builders is quite clear. It was that of a dome placed by means of small pendentives on a decagonal drum. Ten ribs starting from the angles of the polygon divided its surfaces into ten equal parts. Some of the sections were further divided by secondary arches, and the whole formed a well-ordered armature which explains itself, and which can be comprehended at the first glance.

But when one examines the details there are to be found marked inaccuracies in the execution of such a simple conception and the clear traces of a poorly comprehended "parti." The brickwork, as though it had been given too great solidity on commencing, is suddenly simplified some metres above the springing, either through economy, or because in the course of building the first disposition adopted was found superfluous or too wasteful.

The principal ribs, corresponding to the angles of the drum, are composed of five single ribs at their bases, while at the crown there are but three; it might be claimed that this diminution resulted from the desire to give the ribs a width proportional to the circumference of the vault; but while this explanation taken alone might be admissible, a consideration of all the facts shows that the first hypothesis is the only true one, that is, that the armature is a mutilated work whose first conception, put for the moment into practice, was modified little by little in its principal parts. This can be best seen by examining the interpolated work in the different sections of the dome. In one section there are two secondary ribs which stop almost as soon as they commence, and which, not being closed, are entirely useless. In another, a single rib was commenced and built up for a short distance, where it suddenly stops, so that, like the preceding ones, it is without utility; and in the last sections, the builder, fully convinced of the uselessness of the secondary arches, omitted them entirely. So that in the same vault can be seen sections subdivided by two incomplete ribs, others by single ribs, and still others with no division whatever. These arches, commenced, diminished, and abandoned, show experiments, and a hesitation not usually found in the monuments of Roman art. In fact, the Temple of Minerva Medica is clearly a work of the last days of Rome; the plan, as well as the exterior aspect, is marked by characteristics which point to a date which is perhaps quite close to that of the Byzantine Renaissance. The dome of the Baths of Agrippa shows the origin of the method, this one shows its decline, and they are, as it were, the two extremes of a tradition which endured, with remarakble persistence, during the long period of the Empire.

This should be the place to speak of the modifications of the methods applicable to spherical vaults when used in the construction of vaults of a quarter of a sphere or for *cul de fours*, and of how the combinations founded on the use of bricks laid flat were utilized for both. Plates XI., XII., and XIII. show this, I think, clearly enough, Plates XII. and XIII. giving two different models of armatures in the form of linings, while Plate XI. contains examples of large niches constructed on systems of isolated ribs. It is to be noticed what care the builder took to neutralize the thrust of the central rib which butts against the archivolt.

I will add but a single detail. In spherical vaults, where the construction of an armature is always a delicate operation, the Romans bound themselves even less than elsewhere to commence the armature at the springing of the vaults. They built the entire lower part up to a certain level, C, without any armatures of masonry and sometimes even without centres of any kind, guiding themselves by means of a cord equal in length to the radius, fixed at the centre of curvature. Among other examples there are, in the Baths of Caracalla, several vaults over exedras where this method was probably followed.

In order to keep faithfully to the condition I imposed on myself, — to describe ancient construction only through my personal examination of the buildings, — I should perhaps keep silent concerning the dome of the Pantheon; for this vault, covered with a thick coat of stucco, shows us only a series of caissons with no apparent indication of its skeleton. But nevertheless I will, on account of the importance of the edifice, seek the aid of a foreign witness.

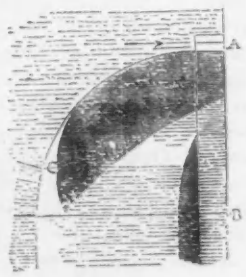


Fig. 48.

Piranesi had an opportunity of studying the detail of the vault when it was repaired under the pontificate of Benoit XIV. The plastering, partly destroyed by time, had to be removed and replaced by a new coating at several points. For this purpose a movable scaffolding was built, pivoted at the summit of the dome and running along the projection of the cornice; and Piranesi, who wished to preserve in his drawings the vestiges of ancient Rome, profited by this ingenious apparatus to observe the smallest details of the dome, of which he could examine the entire interior surface.

Conjectures enter to a regrettable degree into his works, but here nevertheless his testimony merits a certain amount of confidence; the circumstances in which he was placed should be something of a guarantee of his accuracy, and the care he took in drawing the parts of the edifice which are still visible vouches, in a measure, for those things which we cannot to-day verify.

The preceding figure (Fig. 49) is an exact reproduction of a drawing in which Piranesi shows a section equal to an eighth of the vault.

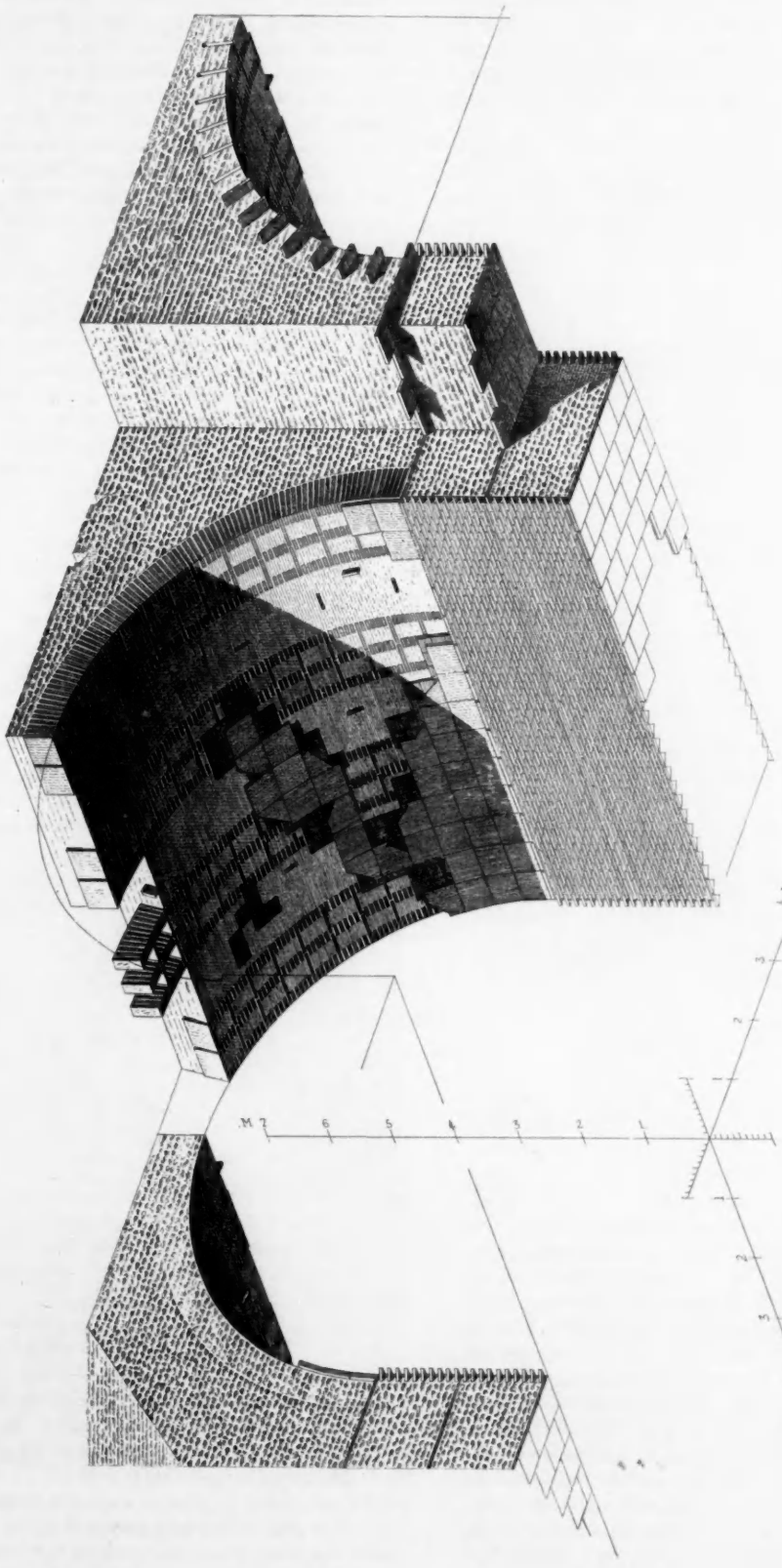


PLATE VI.—THE ART OF BUILDING AMONG THE ROMANS.

In the Pantheon, as in the Temple of Minerva Medica, the framework of the vault consists of a system of meridional ribs C, C. Relieving arches B, B prevent these ribs from bearing on the hollow parts of the drum, and small arches D, D divide into smaller compartments the large sections comprised between two consecutive meridional ribs.

The reason for all the lower parts of the armature can be read in their forms, so we will examine the arrangement of the upper part of this framework of brick.

The two sketches (Figs. 51 and 50) show at two stages of its progress the construction of the upper part of the work, which was, I think, built at two different times. At the summit the meridian ribs C, C originally terminated in the manner indicated in Fig. 50, their inward thrust being received by the ring of bricks E, which formed a border about the circular opening in the summit of the vault, the pressure being distributed over the entire circumference by means of the eight tangent arches O, O.

With the aid of these eight arches the border E of the opening could resist the pressure of the meridional ribs for some time; but as the thrusts increased as the rubble rose, it was more and more

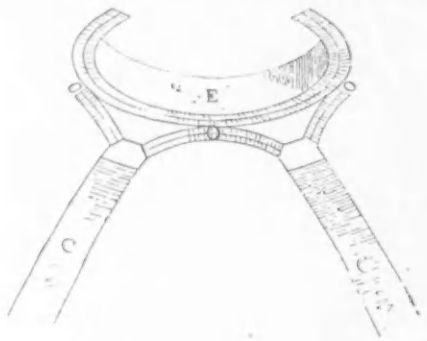


Fig. 50

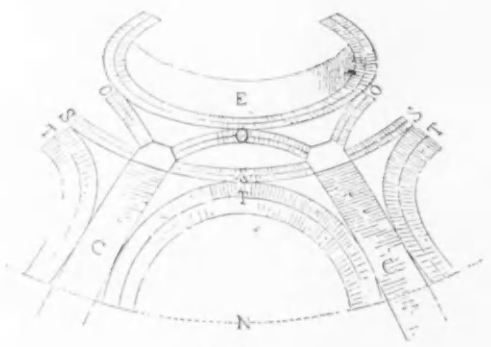


Fig. 51.

compressed until it would be in danger of being crushed. Its resistance was thought sufficient as long as the rubble did not rise above the level N, but when it reached this point it seemed prudent to duplicate all the system about the summit. A second ring, S S S, was built concentric with the eye, and just as the border E E of the eye was braced by the tangent arches O, O, so the new ring was sustained by a series of arches T, T, shown in the figure to the right.

Such is the origin of the arches T, T and of the ring S, which constitute the difference between Figs. 51 and 50. And this is not an imaginary explanation; the second ring S, concentric with the border of the eye, could not have existed without the support of the arches T, and these last could not have been built until the rubble had reached the level N, for otherwise their bases would have had no support, they would have had nothing to rest on. Hence the relative dates we have given to the upper parts of the work are certain, and necessarily so. The large meridian ribs C were maintained only by the ring E during the first period of the work, and it was only when the filling had reached the level N that it was necessary to reinforce it by the second ring S,S, which encircles it at some distance. This succession of parts once admitted, the *rôle* and the form of the armature are entirely explained, and the process which was followed can be conceived without the slightest difficulty. Be that as it may, we present this effort toward an explanation as a hypothesis subject to correction, calling the attention of observers to the circumstances capable of clearing up the questions which arise at the sight of this colossal dome. An existence of nineteen centuries seems a sufficient guarantee of the value of the processes followed; and certain knowledge of these methods would not only give a valuable aid in the advancement of the art of building, but also important facts to the history of ancient architecture.

The dome of the Pantheon rests directly on a circular drum. This was the primitive form of the Roman domes, the form of the round domes of the Baths of Agrippa (Plate X.), and that of all the domed halls built in the earlier part of the Empire. We called attention to the use of pendentives when describing the dome of the Temple of Minerva Medica, but they were brought into use in Roman architecture at a very late date, and the greater part of the examples which could be cited belong to that period of decadence which followed the reign of Diocletian and preceded the Byzantine Renaissance. In the Temple of Minerva Medica the dome is carried by means of pendentives on a decagonal plan; in the Torre de' Schaivi the dome was carried by rudely formed pendentives on an octagonal plan; and in a monument that belongs to ancient rather than to Byzantine art, in the tomb of Placida, at Ravenna, is a dome — the one in the central part — on a square plan. Thus was foreshown, step by step, the wide application of the use of pendentives, from which the architects of the time of Justinian, in the sixth century, were to develop an entirely original system of construction.

(*To be continued.*)

TO DRAUGHTSMEN.

ANY draughtsman out of employment, who will send us his full address and answer the following questions: —

By whom were you last employed?
Can you furnish good recommendations from your last employer?
On what particular line of work have you been engaged?
What salary do you expect to receive?
Are you willing to go to another city?

may have his name placed in our Exchange Bureau, and will be notified of any parties desiring his services as a draughtsman.

All such communications will be regarded as confidential, and no charge will be made.

Address, EXCHANGE BUREAU,
THE BRICKBUILDER PUBLISHING CO.

TO ARCHITECTS.

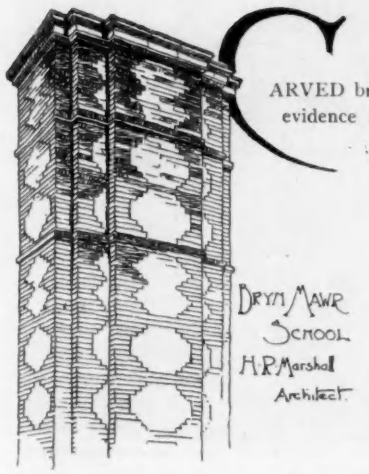
WE call your attention to the foregoing announcement, and upon your application would be pleased to put you in communication with any draughtsman whom we think would meet your requirements. All communications will be regarded as confidential, and no charge will be made.

Address, EXCHANGE BUREAU,
THE BRICKBUILDEB PUBLISHING CO.

WE desire to call attention to the announcement of competition which we make in another column. It is proposed to have a series of these competitions, which will be judged by a jury of experts. We desire by these competitions to stimulate a thoughtful expressiveness in brick and terra-cotta designs, and while wishing to encourage that best kind of originality, which grows out of the endeavor to give the clearest and most poetical expression to new conditions, we commend also to those who take part a careful study of the best work of the past, and would urge designers to remember that nothing is beautiful that is not fit.

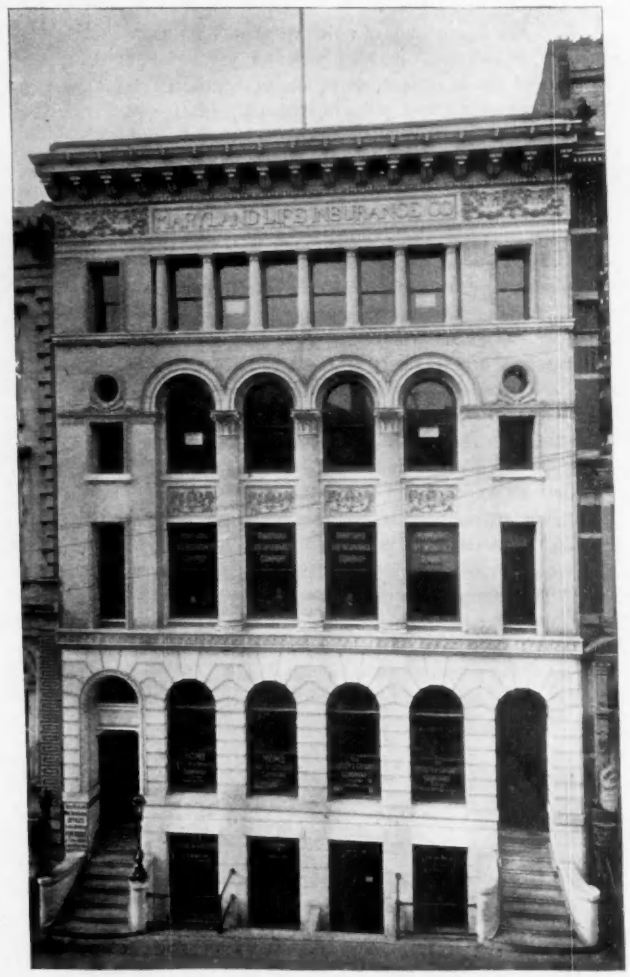
Recent Brick and Terra-Cotta Work in American Cities.

BALTIMORE.



CARVED brick, which at one time gave evidence in Baltimore of becoming a legitimate and permanent feature in architectural decoration, and seemed to lend itself freely to artistic treatment, with effects not attainable in moulded work, has never been used in Baltimore to any extent, a few fairly good examples appearing at one time, when that kind of work first became prominent some years ago, but they did not develop into anything more extended, and of later years we know of nothing of the kind that has been done in any way. It is asserted that the quality of the Baltimore brick, while superior in all other points, does not lend itself to tooled work with the same success as that of the clay from some other localities, of Philadelphia, for instance; but we are not able to say with authority whether this statement is an actual fact, or merely the result of prejudice on the part of those who are opposed to any innovations into time-honored methods, and the contamination of good mechanical processes by any freehand, artistic touches that would not be amenable to a two-foot rule. About the same period a small amount of excellent work of the kind was done in Washington, notably some of the details on dwellings designed by the late Mr. Richardson, but there also no further progress was made, and we remember no carved brick of late years in the national capital.

MUSIC HALL, BALTIMORE.
T. HENRY RANDALL, ARCHITECT.



MARYLAND LIFE INSURANCE COMPANY'S BUILDING, BALTIMORE. JOS. EVANS SPERRY, ARCHITECT.

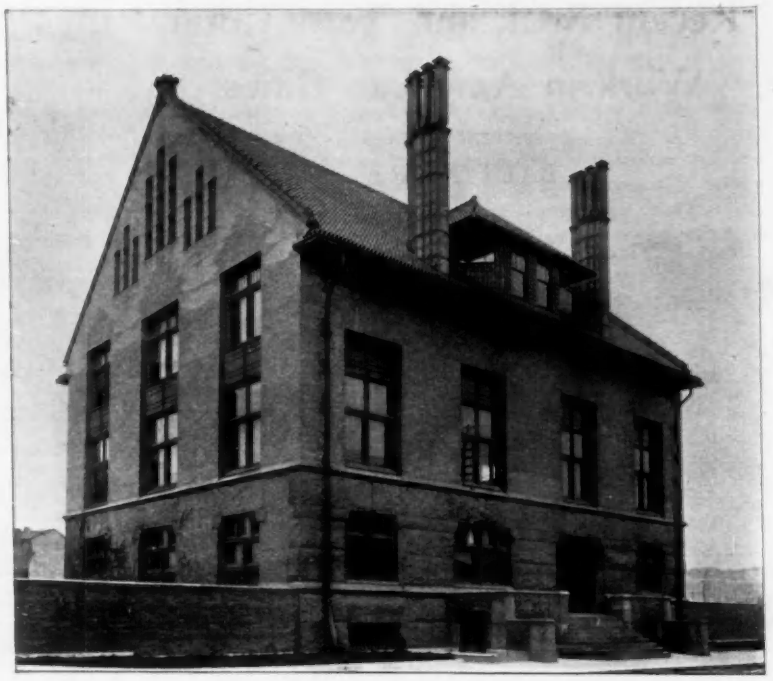
Upon five conspicuous buildings, erected in the last few years, is to be found nearly all the important terra-cotta work done within that period, used as the prominent decorative feature of the design, combined with brick and stone in the construction. These five buildings are the Equitable Life Insurance, from the office of the late Mr. C. L. Carson; the new Music Hall, designed by Mr. T. Henry Randall; the Drovers and Mechanics Bank, and the Maryland Life Insurance, by Mr. J. E. Sperry; and the façade of the Johns Hopkins Hospital, designed by Cabot & Chandler. Of the Equitable Building we have

TERRA-COTTA CAPITAL, MARYLAND LIFE INSURANCE CO.'S BUILDING.

not been able to obtain a desirable view or detail drawings; it is, however, the largest and most important ten-story office building in the city, and as a design a very satisfactory combination of buff brick and terra-cotta upon a granite base.

The new Music Hall, of which we show both photographic view and detail drawing, while as yet devoid of its principal façade (the construction of which is temporarily postponed, from point of economy), gives sufficient evidence, in the pavilion already completed, of the highly ornate style of the design, eminently appropriate for a building of that character, and showing a liberal use of florid detail with a rich combination of yellow tones, that, when completed, will render it one of the most successful expressions of a large concert hall that has lately been produced. Its adaptation to special conditions of the somewhat peculiar surroundings of its site is not so happy, and its merits will never be seen to the same advantage as if it were otherwise located. The very simple and inexpensive design of its rear elevation, constructed of ordinary brick with flat pilasters having terra-cotta caps, is an evidence of how a fairly good thing may be done with cheap materials by a mere careful consideration of proportions.

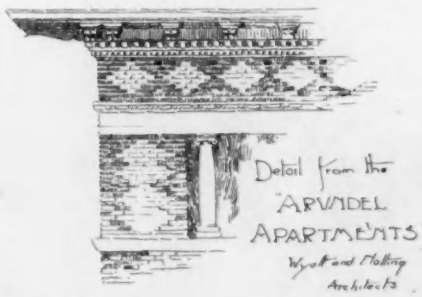
The Maryland Life Building, a combination of buff brick and terra-cotta on a white marble base, shows also a very satisfactory façade, the terra-cotta Corinthian columns supporting the arches, giving it a monumental and classic aspect, with detail appropriate to the material, and the total result is harmonious, producing generally a very satisfactory impression upon the public, who, we usually find, in the long run, approve of a good thing, even if they may not know why. The construction of the cornice, by means of a species of iron brackets bolted into the wall and upon which the terra-cotta is partly hung, is worthy of notice. Another prominent building, by the same architect, as yet unfinished, is that of the Baltimore Herald,



BRYN MAWR SCHOOL. H. R. MARSHALL, ARCHITECT.

also buff brick and terra-cotta on a white marble base; the terra-cotta detail around the windows and in the top story, forming a sort of frieze to the whole design, is very ornate; but the general tone of the brickwork, showing a pale, pinkish tinge, does not produce a result as satisfactory in color, in the whole combination, as that of the other examples mentioned. As examples of successful results obtained by the simple use of bricks in flat designs of harmonious colors and little other ornamentation, among the best we know of are the two buildings shown, the Bryn Mawr School, by T. R. Marshall, and the Arundel apartment house, by Wyatt & Nölting. Both buildings are severely simple and plain in form, both have interest from the good proportion of their flat wall spaces and openings, with few details beyond a cornice or balcony in one, or a tall chimney design in the other; both are more or less expressive on the exterior of the respective purpose of the building, but both derive by far the larger part of their claims to our interest in the color treatment in brick of their flat surfaces. In the school building this is a dark,

ARUNDEL APARTMENTS. WYATT & NÖLTING, ARCHITECTS.
Golden Buff Brick by Sayre & Fisher Co.



rich combination of warm browns and buffs, above a massively treated reddish brownstone basement, and with a gold-brown tile roof, while in the Arundel the effect is a bright, golden buff, clear and clean, but varied, combined with a pattern in a red old gold and a cream-color sandstone. With these buildings we close the list of those at present worthy of special note in Baltimore, for any particularly good use of brick or terra-cotta work.

J. B. NOLL WYATT.

FOURTH PRESBYTERIAN CHURCH, INDIANAPOLIS, IND.

W. AND G. AUDSLEY, ARCHITECTS, NEW YORK.

THIS church, erected at the northeast corner of Alabama and Tenth Streets, Indianapolis, is a small but highly satisfactory specimen of brick and terra-cotta church architecture. The exterior is of rich red brick, relieved by bands of chocolate brick; and the whole of the finishings, including the tracery of the three rose windows and the frames of all the other windows, are of deep buff terra-cotta. It is to the harmonious effect of color — red, chocolate, and buff — that much of the beauty of the building is due. The buttress weatherings are formed of brick, set diagonally, and are highly satisfactory in work. The design of the exterior is somewhat severe, and is entirely devoid of effort or straining after meretricious effect. Plates 23 and 24 show elevation and plans.

ONE of the striking examples of recent brick and terra-cotta work in New York City is the store building 704, 706 Broadway, DeLemos & Cordes, architects. The façade is built of white brick and terra-cotta, the brick being of the same kind as those used by Carrère & Hastings in the Jefferson Hotel at Richmond.

PLATES 19 and 20 illustrate elevation and plans of a colonial residence designed by J. William Shaw, Philadelphia, and built of brick, Flemish bond with black headers.

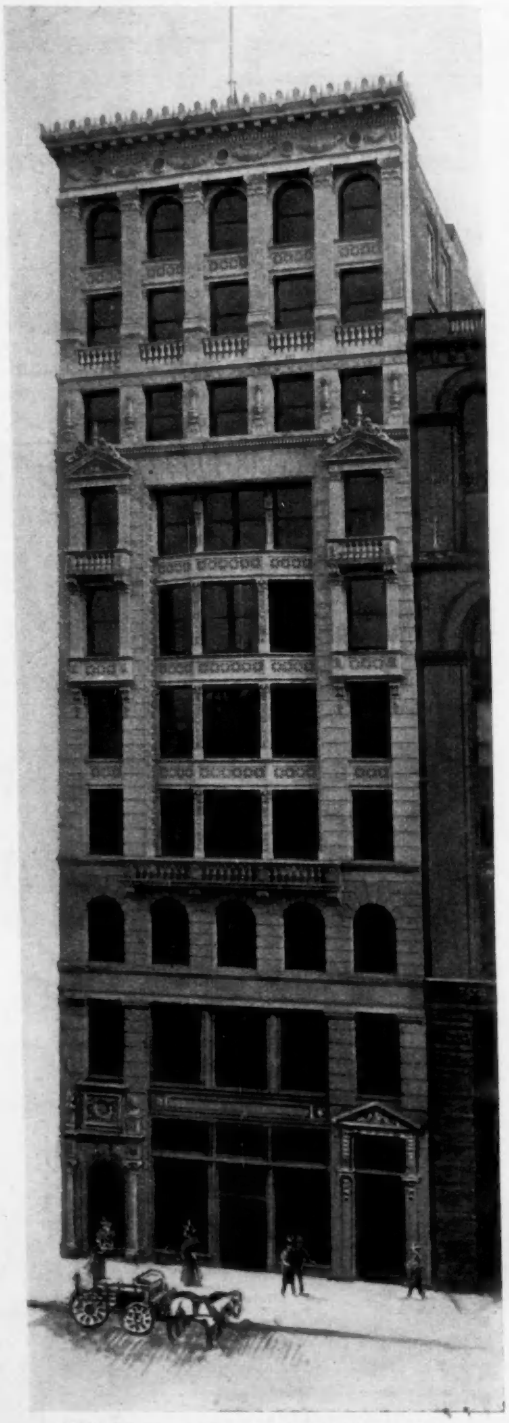
NEW ADVERTISEMENTS.

ON page xv may be found the new and very attractive advertisement of the Conkling-Armstrong Terra-Cotta Co., Philadelphia. Messrs. Armstrong and Conkling have been long and favorably known in connection with the manufacture of architectural terra-cotta, and bring to their new enterprise that skill which is obtained only by years of experience. Their new plant is most admirably situated at Tioga, Philadelphia, and has been equipped with the most improved machinery.

We would announce to those interested that Mr. Chas. E. Willard has recently opened an office at 171 Devonshire Street, Boston, and carries a full line of brick, terra-cotta, tile, drain pipe, metallic paint, lime, etc., representing a number of companies well known in these particular lines. The fine display which Mr. Willard has erected in his office is certainly well worth visiting; there are some sixty different styles and shades of brick arranged in such manner as to bring out just what effects may be produced in the way of combination of colors and styles of brick. Such an exhibit gives a more accurate idea of the appearance of any particular shade of brick when "laid up" than could be obtained by single samples. We certainly feel that a display of this kind is of decided benefit and should be encouraged.

Mr. Willard does not enter this field as a stranger. His long connection with one of the best known firms in the country has brought him many acquaintances and friends, who extend to him their best wishes for success.

For details regarding the lines he represents we would refer to his advertisement on page xiv.



STORES 704, 706 BROADWAY, NEW YORK.

WHITE BRICK FURNISHED BY THE POWHATAN CLAY MANUFACTURING CO., RICHMOND.

BRICKBUILDER COMPETITIONS.

WE desire to announce a competition open to all draughtsmen who are subscribers to THE BRICKBUILDER, for a city house of brick. The house is to have a frontage of twenty-five feet on the street. The lot is eighty feet deep. The house will have four stories over the basement, and its cost must not exceed $16,000. The front will be of brick, with architectural detail of moulded pressed brick, taken from the catalogues of our advertisers, or of pressed brick and terra-cotta; colored faience may be introduced into the ornamentation if desired. The drawings will be made in line with black ink on two sheets, cut to the uniform size of 14″ x 18″. One sheet will show the elevation at a scale of one fourth inch to the foot; the other, the plans of the first and second floors at a scale of one eighth inch to the foot, and details of the façade (especially the cornice) at a scale of one half inch to the foot. The style of brick bond adopted must be clearly shown on the elevation. Drawings must be received at the office of THE BRICKBUILDER not later than the first day of June. THE BRICKBUILDER offers a first prize of $60, a second prize of $40, and a third prize of $20. In addition to these prizes, THE BRICKBUILDER offers a special prize of $40 for that design, *accompanied by specifications*, for a similar brick house, of fireproof construction throughout, which can be executed at the lowest cost. In awarding this special prize, only those designs will be admitted to competition which reach a certain standard of excellence in design; but beyond that, the awarding of the prize will depend on the excellence and the economy of the construction called for in the specifications. Designs unaccompanied by specifications will be regarded as being entered only for competition for the first three prizes. This special prize may be taken by one of the winners of the other prizes, or by another, as the case may be. The question of cost will be submitted to an expert builder. The prizes will be awarded by a jury of three architects of acknowledged reputation.

Each drawing must be marked with a motto or cipher, and a sealed envelope similarly marked, containing the full name and address of the designer, must accompany the drawings. These envelopes will not be opened until after the award is made.

THE BRICKBUILDER reserves the right to publish the prize designs and the prize specification. Other drawings may be published with the permission of their authors. At the conclusion of the competition all drawings will be returned to competitors. Drawings must be delivered flat, express or postage prepaid.

DRAUGHTSMEN WANTED

To confer with us as to how they may obtain a *free subscription* to THE BRICKBUILDER for 1895.

We can only accommodate a limited number in each city. If you wish to be included, we would advise your writing us at an early date.

THE BRICKBUILDER PUBLISHING CO.
85 WATER ST., BOSTON.

OUR ILLUSTRATED ADVERTISEMENTS.

THE church of San Giacomo Maggiore — or St. James the greater — at Bologna is the subject of the plate published this month by the Hydraulic Press Brick Co. (See page xix.) The apse and campanile were begun in the thirteenth century, but the church was not finished until the fifteenth century. The top of the tower and the arcades along the side of the church are of the later date. Arcades of similar character protect the sidewalks of most of the Bolognese streets, and form one of the pleasantest and most characteristic features of the street architecture of the city.

Madonna and Child, by Andrea della Robbia, is the subject of this month's illustration by The Atwood Faience Company. (See page xvii.) It is from a photograph of the original in the sacristy of the church of Santa Croce, Florence.

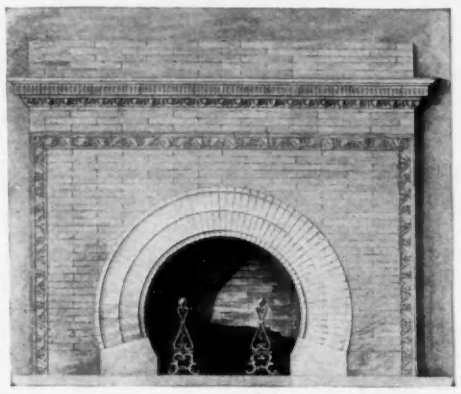
The accompanying illustrations are of terra-cotta detail used in the façade of the Post Graduate Hospital, New York, which is illustrated in the advertisement of the New York Architectural Terra-Cotta Company, on page xviii.

The Chamber of Commerce Building, Rochester, N. Y., another example of recent brickwork, is illustrated in the advertisement of the Eastern Hydraulic Press Brick Company, on page xx.

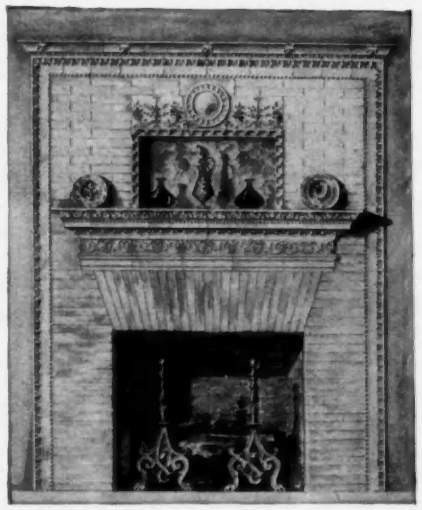
THE MECHANICVILLE BRICK COMPANY, Mechanicville, New York, write us as follows: "Some time ago we read in THE BRICKBUILDER an article on Roman brick made in common red brick, and opinions of different architects in regard to same. Inspired by the article we have fitted up for making such brick, and are prepared to furnish them in quantities."

THE AMERICAN CERAMIC TERRA-COTTA CO., Chicago, have secured the contract for the terra-cotta on the Yerxes Observatory to be erected at Geneva. Mr. Henry Ives Cobb, architect.

ON one thing all are agreed. It is that some of the most artistic effects are obtained by the use of brick and terra-cotta in the construction of fireplaces and mantels.

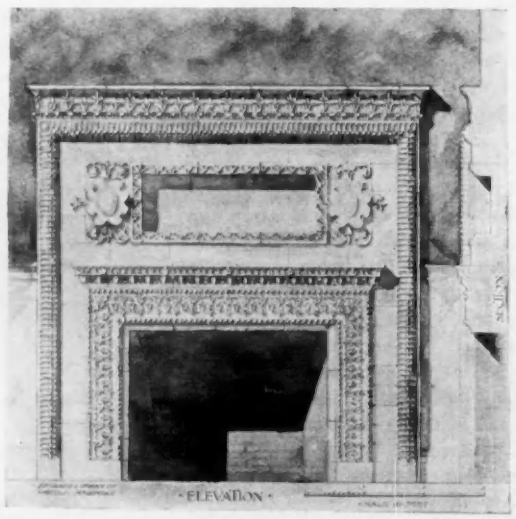


In the selection of brick for such work only first-class material should be used, otherwise there is likely to be serious trouble from the bricks chipping. We know of instances of this kind where as a result



of the use of soft brick it has been necessary to tear out and rebuild fireplaces.

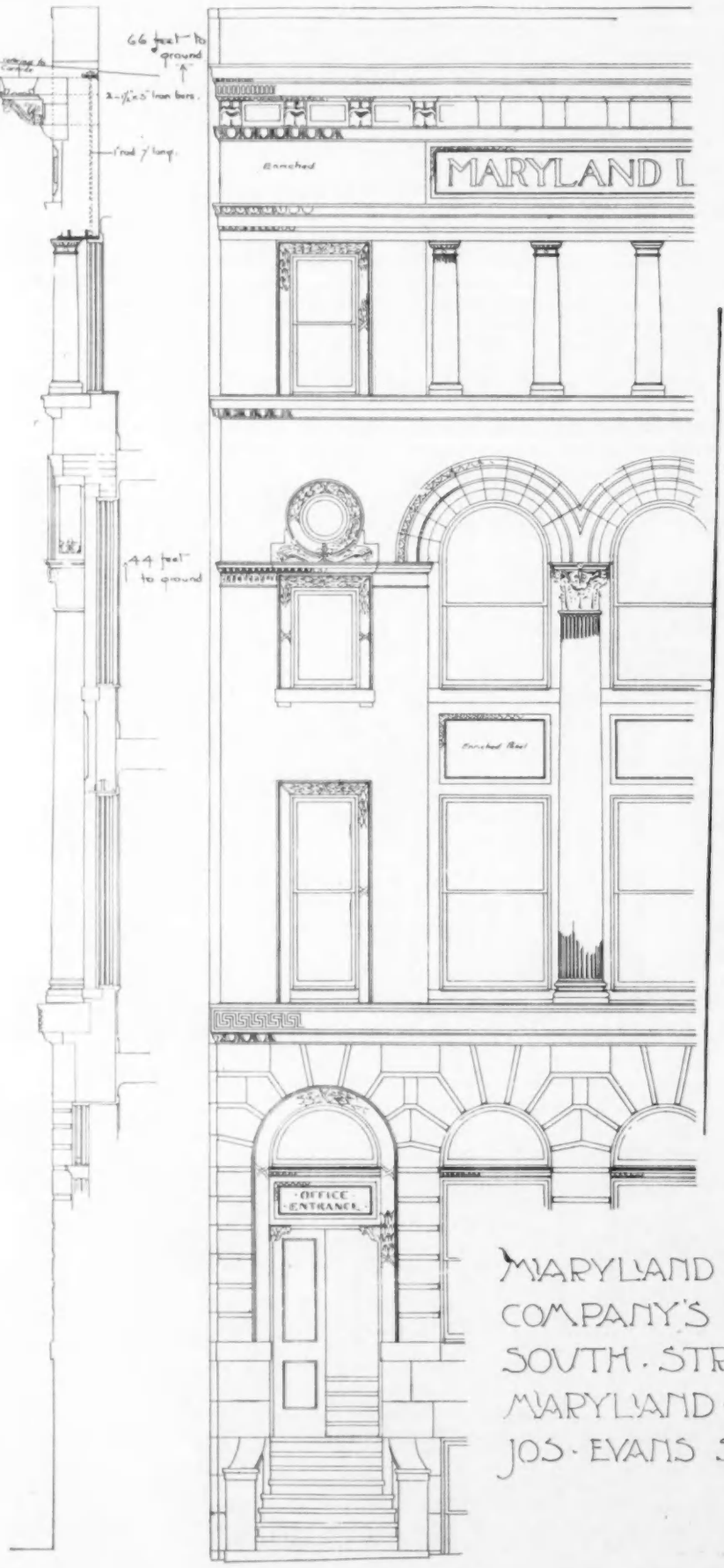
By permission of Messrs Fiske, Homes & Co. we have selected

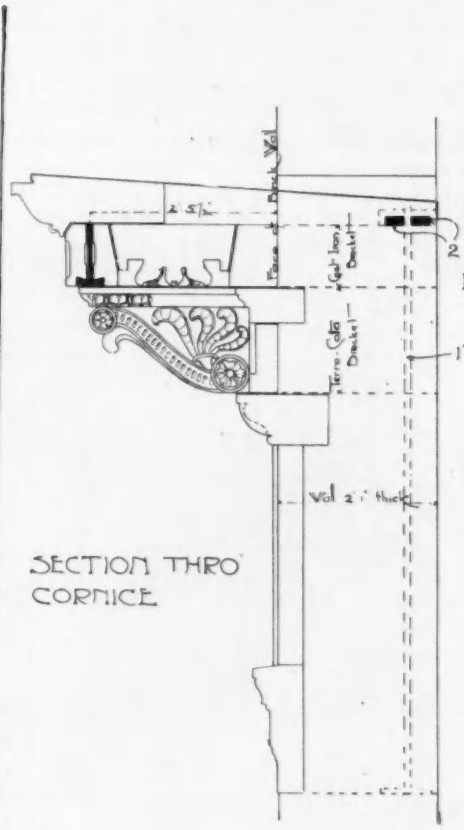


from their new catalogue entitled "Open Hearth" three designs for brick fireplaces and mantels, illustrations of which we publish herewith.

MUSIC HALL · · BALTIMORE · · T·HENRY RANDALL·ARCHITECT·

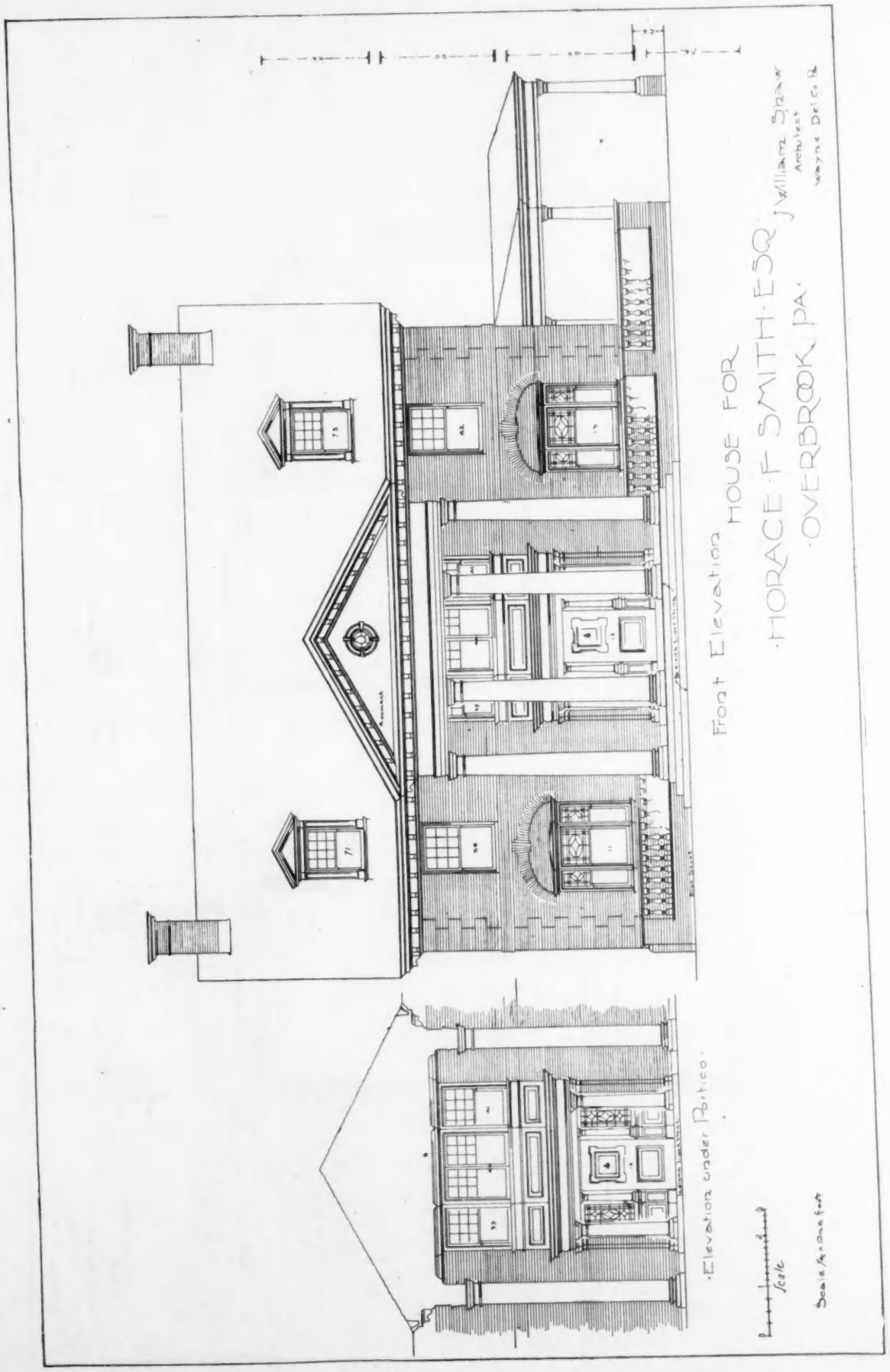
The Terra-Cotta used in this building was executed by the New York Architectural Terra-Cotta Co.

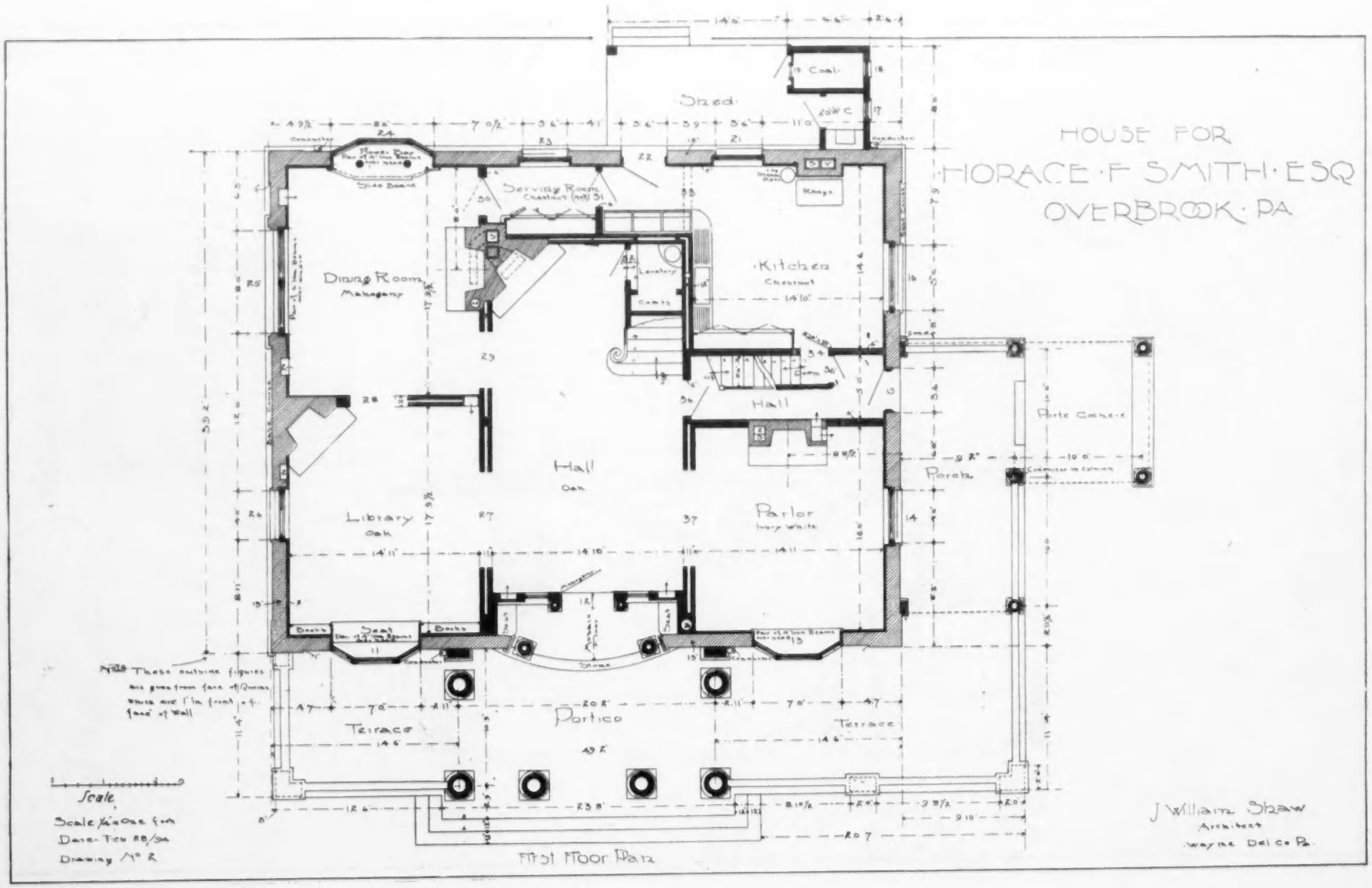


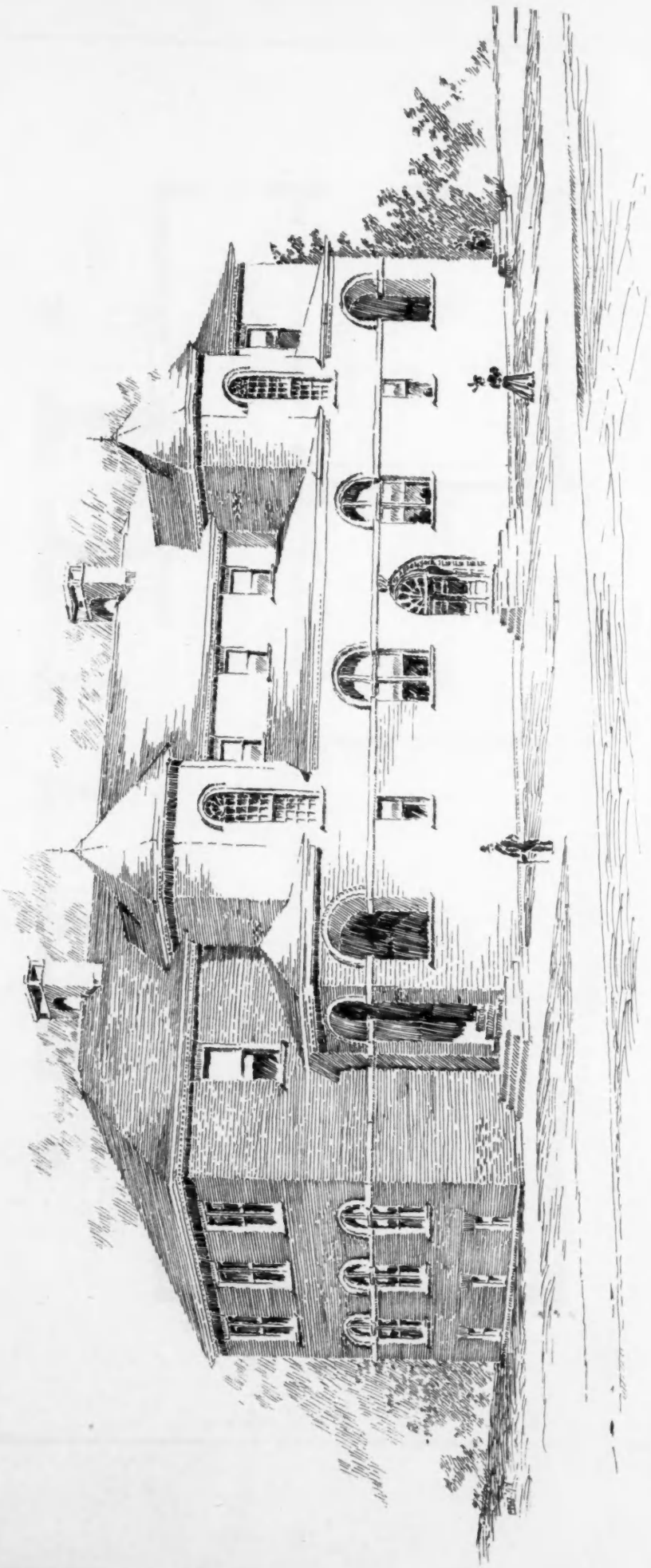


SECTION THRO CORNICE

MARYLAND LIFE INSURANCE COMPANY'S BUILDING · SOUTH · STREET · BALTIMORE MARYLAND · JOS · EVANS SPERRY · ARCHITECT


HOUSE FOR
HORACE F. SMITH. ESQ
OVERBROOK, PA.
J. Williams Sharp
Architect
Wayne Del Co Pa
Front Elevation
Elevation under Portico.
Scale
Scale 1/8 = one foot


HOUSE FOR
HORACE F SMITH ESQ
OVERBROOK PA
Shed
Coal
Serving Room
Chestnut
Kitchen
Chestnut
Dining Room
Mahogany
Hall
Oak
Library
Oak
Parlor
Ivory White
Porte Cochere
Porch
Portico
Terrace
Terrace
Hall
Scale
J William Shaw
Architect
Wayne Del Co Pa.
First Floor Plan



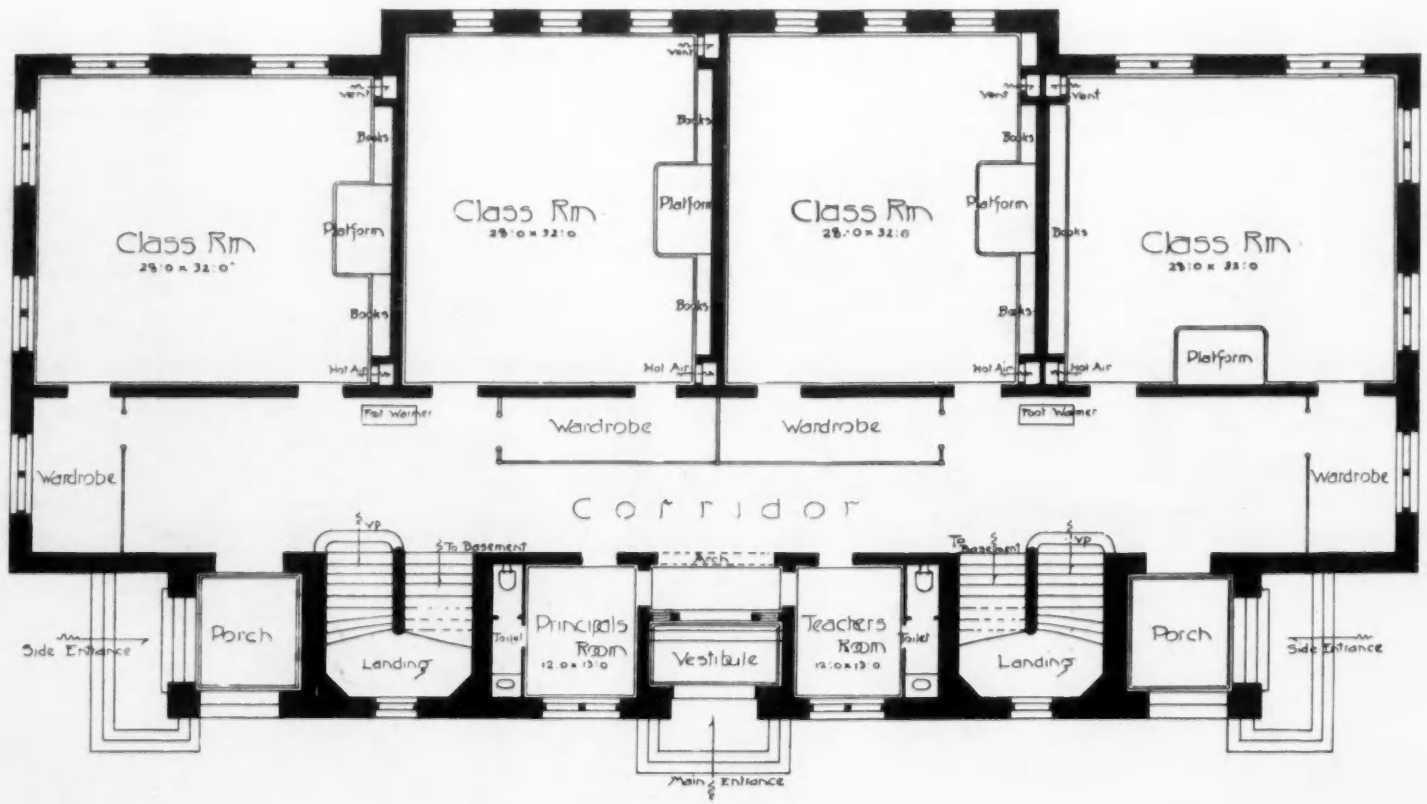
GRADE SCHOOL, NEW BEDFORD, MASS.
EDWARD ,, WILSON, S. ADAMS WEBBER, ARCHITECTS, BOSTON.

·GRADE · SCHOOL · NEW · BEDFORD · MASS ·

·EDW·I·WILSON · ARCHITECT ·

·S·ADAMS·WEBBER· 92·MASON·BLDG·

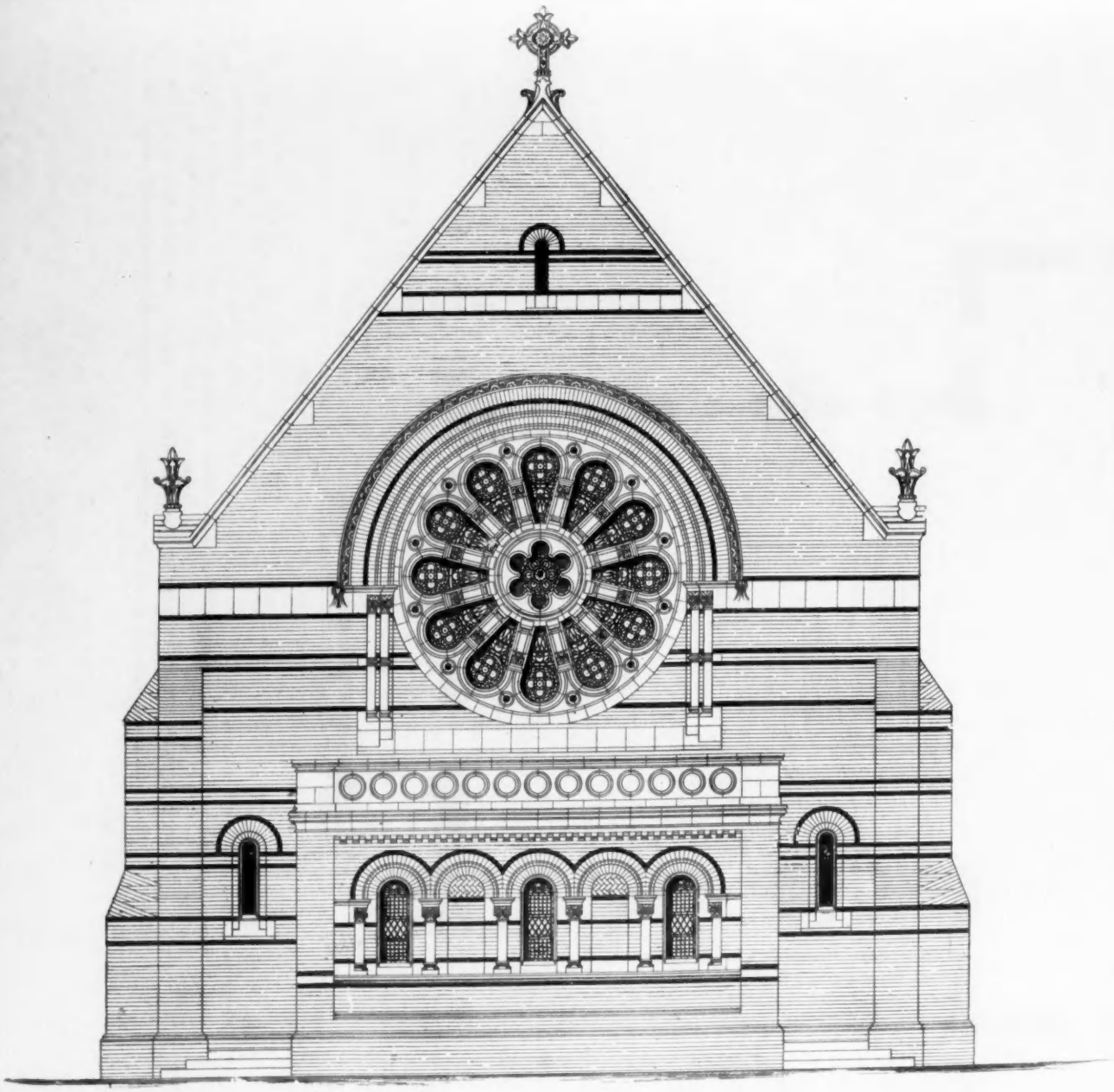
·BOSTON·



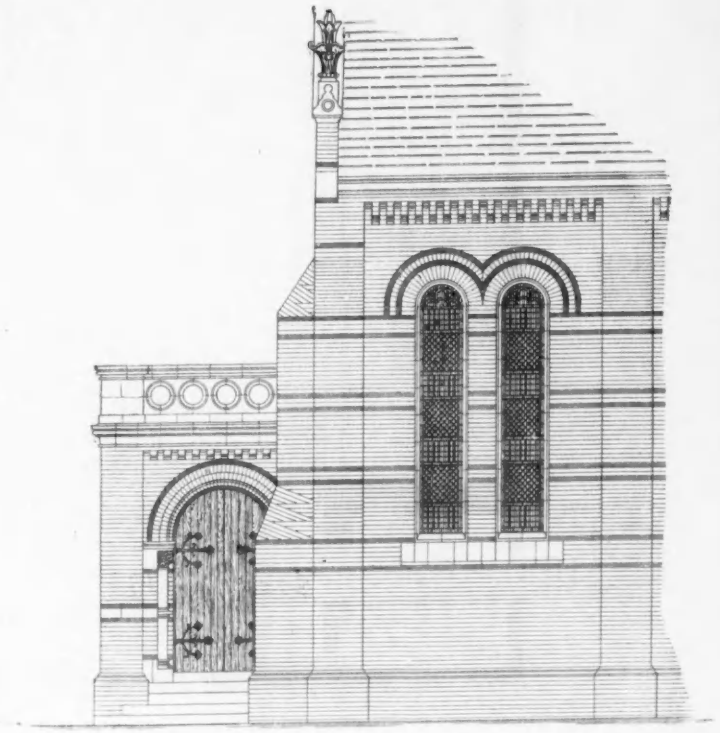
·First·Floor·Plan·

Scale 1/8 in: 1/ft

Scale



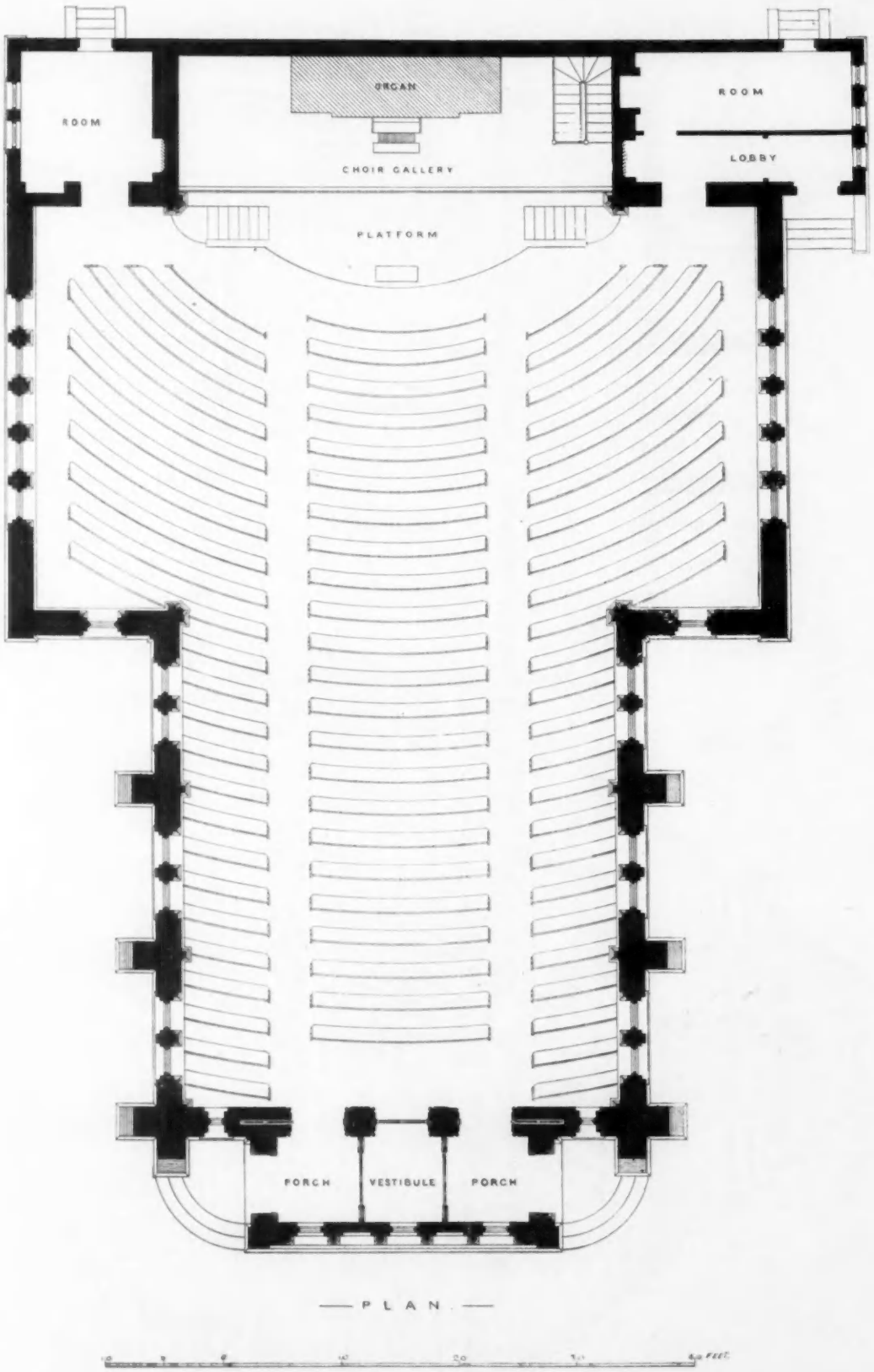
FRONT ELEVATION.



SOUTHWEST ANGLE OF NAVE.

FOURTH PRESBYTERIAN CHURCH, INDIANAPOLIS, IND.

W. AND G. AUDSLEY, ARCHITECTS, NEW YORK.



— PLAN —

FOURTH PRESBYTERIAN CHURCH, INDIANAPOLIS, IND.

W. AND G. AUDSLEY, ARCHITECTS, NEW YORK.

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

CUSHING BUILDING, 85 WATER STREET, BOSTON.

P. O. BOX, 3282.

Subscription price, mailed flat to subscribers in the United States and Canada	$2.50 per year
Single numbers	25 cents
To countries in the Postal Union	$3.00 per year

COPYRIGHT, 1893, BY THE BRICKBUILDER PUBLISHING COMPANY.

Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

WE think it may be worth while to call the especial attention of some of our readers to the translation, now appearing in our pages, of Choisy's well-known work on "The Art of Building among the Romans," which has hitherto been accessible only in the original French. We undertook this translation, not merely because of the great interest and value of the work as an essential to the proper understanding of Roman architecture, but because we felt convinced that it was full of suggestions of the greatest practical value. We commend its perusal, therefore, not only to the architect interested in an important branch of the history of his art, but to the practical man on the lookout for new and improved methods of construction. We say "new," meaning "new to us," for it will be found that many of the devices which we speak of as "new," and fondly regard as inventions of this ingenious nineteenth century, have been anticipated by the Romans or other ancient peoples. Many of the methods of vaulting used by the Romans, and so clearly described by Choisy, are applicable to our modern fireproof buildings. A modification of one of these old Roman methods, the so-called Guastavino vaulting, was introduced here a few years ago by Signor Guastavino, from Spain, where it is a traditional method of work, dating back in origin undoubtedly to the time of the Romans. We refer to the well-known success of this method as a signal example of good practical results from the adoption of a Roman method. We believe that a further study of the methods of Roman construction, as elucidated by M. Choisy, would prove fruitful of like excellent results. The best and most permanent use of brick is, undoubtedly, to be found in connection with such a system of concrete construction as the Romans employed.

A SPLENDID recent example of the application of Roman methods to modern work is to be found in the construction of the new Congressional library at Washington. Comparatively little iron enters into the construction of the building, and almost every form of Roman vault is to be found here. When, however, the method of vaulting is examined in detail, it is found to follow modern rather than Roman methods. We believe that a still closer following of Roman methods would have been an economy in the work. In the Congressional library continuous centerings have everywhere been employed, whereas the Roman method employs a skeleton of masonry ribs or arches, which form, as it were, a permanent centering for the support of the brick and concrete vaulting, thus greatly reducing the amount of wooden centering required. The enormous strength of this method of construction is attested by the numerous Roman ruins, even vaults that have fallen by the destruction of the walls often retaining their shape. By the use of the Roman method, iron can be dispensed with altogether, when the buildings are not of exaggerated height, and we believe this omission increases the chance of permanent stability.

THIS revival of some of the excellent methods and building materials of earlier ages is one of the encouraging signs of the times, and has been nowhere more marked than in the revival of the manufacture of terra-cotta, both structural and ornamental. Structural terra-cotta, employed in our modern buildings, especially those used in connection with iron, is essentially modern, but our use of ornamental terra-cotta is but a revival of earlier methods, mainly those of the Renaissance architecture of North Italy, but which date back to the Romans and the Greeks, the Persians and the Assyrians. Our method of enclosing iron beams in terra-cotta casings is not unlike that employed by the Greeks for encasing wooden beams. As a rule, our casings are, in turn, covered over with plaster, but we might well take a hint from the Greek builders of Sicily, five or six hundred years before Christ, and make these terra-cotta casings themselves ornamental. Much is to be learned from the study of these Greek terra-cottas, used in the structure and decoration of buildings. The making of such a finial or akroterion, as that of the temple of Hera, at Olympia, a great plaque, over seven feet in diameter, and richly decorated, which dates back to the eighth century before Christ, is a feat our best terra-cotta manufacturers would be proud of to-day, and no colored faience or terra-cotta has been made which can compare in either beauty or brilliance with the great frieze of the archers which decorated the palace of the Persian monarchs at Susa. We mention these things to emphasize the advantage of studying the best work of elder days. Our terra-cotta manufacturers have made great strides, and the recent rediscovery of methods of producing glazed colors which will stand the weather, opens up "fresh fields and pastures new" to the designer. A careful and loving study of the splendid work that has been done in similar materials in the past will help us to make the best use of these resources, still so new to us, and stimulate to further progress.

The increasing use of a method of construction which is essentially an iron frame, encased in terra-cotta, ought to lead to a consistent development of decorative forms in terra-cotta in harmony with the new method of construction, and in this new development we believe that colored faience is sure to play an important part. In France especially some not altogether unsuccessful attempts in this direction have recently been made, which ought to be helpful in our endeavors to apply these old methods to new conditions. In our high buildings especially, the use of traditional architectural forms, which are the outgrowth of what might almost be referred to as the opposite method, the method of construction in courses, do not seem to be quite in place. As yet the method of construction itself may be said to be on trial, and there are not wanting, as the discussion at the last meeting of the A. I. A., in New York, showed, architects of the greatest experience who condemn it altogether.

NOTHING more foolish, we think, has ever been done in the name of organized labor than the passage of the recent law by the Legislature of the State of New York, obliging all dressing of stone, used for city work, to be done by American citizens. It was supposed at first that the law would apply only to stone used for buildings. It now appears, however, that it is applicable also to stone used for paving purposes, and it has been hinted that the law was passed, not in the interests of native "labor," but in the interests of paving companies who are rivals of the stone pavers. Our legislative methods are dark and mysterious, but the law on its face looks more like a foolish move of "labor" than a shrewd move of "capital." That its effect will be to increase the demand for brick and terra-cotta we can hardly doubt, but no one yet has had the temerity to accuse the brick and terra-cotta manufacturers of fathering the measure.

Fireproofing Department.

Conducted in the Interests of Building Construction to Prevent Loss by Fire.

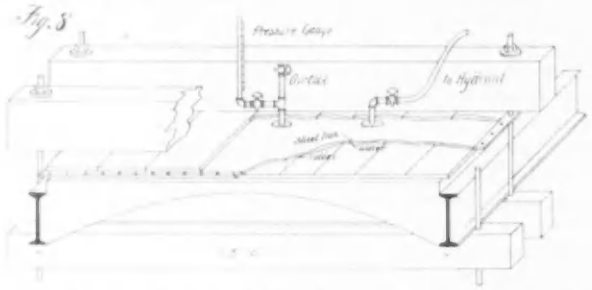
FIREPROOF FLOOR ARCHES.

(*Continued.*)

BY GEORGE HILL, C. E.

PUBLISHED TESTS. — CONTINUED.

St. Louis Tests. (*Engineering Record*, May 7, 1892.) These were tests made by Messrs. Johnson & Flad of concrete floor arches in the Wainwright Building. The arches were of various spans, but those tested were about 8′, with a depth at the abutments of 15″, a rise of about 12″, and a thickness at the crown of 2½″, and were true segmental arches. The load was applied by bolting heavy wooden beams over the arch and between the arch and the beam, placing a bag under them, one side of which was of sheet iron and the other of rubber, and filling the space between with water under pressure. (See Fig. 10.) The static tests were made as follows: —



Uniform Load. (33.) The arch was composed of four parts by volume of breeze to one part of Acme cement, and the arch was about two months old when tested. It was 8′ span, 4′ 11″ width, 2½″ deep at the centre, 15″ at the abutments, and was built between 12″ I beams, the top of the arch projecting 3″ above the top of the beams. The beams were provided with two 1¼″ round rods connecting the bottom flanges, one at each end of the section tested. The load was applied to a surface 7′ 4″ x 4′. The arch broke at the centre along a line parallel with the I beams with 16,400 pounds, corresponding to 559 pounds per square foot.

Uniform Load. (34.) The arch was composed of four parts by volume of breeze to one part of Alsen Portland cement for a depth of 3′ measured up from the surface of the intrados; the balance was composed of eight parts of breeze to one part of the same cement. The arch was about two months old when tested; the span was 8′, the width 4′ 4″, depth at centre 3″, depth at abutments 15″. The skew-back beams were of 12″ beams riveted to the supporting girder 15′ from end of the test arch at one end, and the other end was secured by a 1¼″ tie rod passing through the centre of the web at the centre of the width of the arch, and a 1¼″ tie rod connecting the bottom flanges at the end of the arch. The load was applied to a surface 7′ 4″ by 4′. The arch broke at the centre as before with a total load of 39,360 pounds, or about 1,340 pounds per square foot, and carried this load when the deflection at the centre was 1¼″.

Eccentric Load. (35.) The arch was constructed of four parts by volume of breeze to one part of Alsen Portland cement, and was somewhat more than two months old when tested. It was of 8′ span, 4′ 7½″ wide, between 2½″ and 2¾″ deep at the centre, 15″ deep at the abutments, and was built between one 15″ and one 12″ beam, the top of the arch being flush with the top of the 15″ beam. The beams were held from spreading by means of a 1¼″ rod passing through the web of the beams and two 1¼″ rods connecting the bottom flanges of the beams, one at each end of the section tested. The load was placed on the half of the arch next the 15″ beam on an area of 4′ long by 3′ 11″ wide. The arch broke along two lines parallel to the beams, one at the centre and the other 2′ therefrom, and under the loaded area, under a load of 12,027 pounds, equivalent to 768 pounds per square foot of the loaded surface.

No statement is made as to what the deflections were, as to whether or not there was any spreading of the beams, as to whether or not the arch failed by compression, nor as to the weight per superficial foot of floor area. From tests which will be subsequently given, I should judge that the failure was probably due to an elongation of the tie rods, or else that breeze is a very poor material to use, as the absolute strength of the arches was rather low for concrete of a good character.

Austrian Tests. (36.) (*Engineering News*, Aug. 24, 1893.) Communicated by F. E. Von Emperger.

Kind of Arch.	Span.	Rise.	Thickness.	Breaking Load.
Brick.	13.3	15 3-4	6 inches.	321.5
Concrete.	13.3	15 3-4	4 inches.	737.3
Monier.	13.3	15 3-4	2 3-8 inches.	839.7
Melan.	13.3	11	3 1-8 inches.	3,360.0

In the above the span is given in feet, rise and thickness in inches, and the breaking load in pounds per square foot. The Monier arch was built of concrete, with iron rods on the intrados. The Melan arch was built with three and one eighth inch I beams of steel, the concrete mixed one to five, and the general form of erection was as shown in Fig. 10. In order to secure a proper concentration of the load a wooden frame, enclosing an area of ten square feet with a funnel-shaped central portion, was constructed, and this was filled with gravel and loaded on the top. The centre of the frame was placed immediately over one of the steel ribs, which were spaced three and three tenths feet apart. There were four of these ribs placed in line, and the loading was concentrated over one of the central ones.

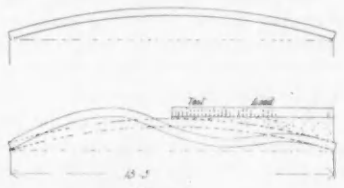
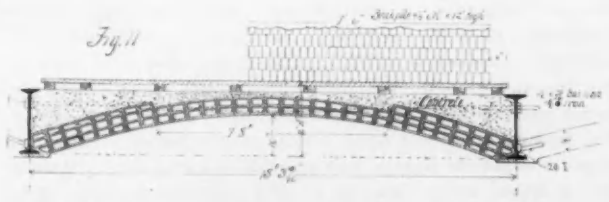


Fig. 10.

The arches failed first at a point immediately under the centre of gravity of the load, or at the corresponding point opposite it where the tension was a maximum. The Melan arch, when it failed, simply crushed down the one beam, leaving the other beam on either side intact. No information is given as to the amount of deflection, nor as to the character of the collapse when it finally occurred.

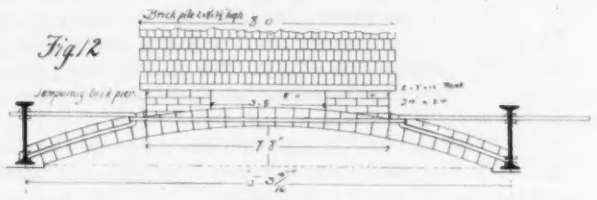
Porous Terra-Cotta Tests. (37.) (*Engineering Record*, April 14, 1894.) Staten Island Terra-Cotta Lumber Company. These were tests made of full sized porous terra-cotta lumber segmental arches. The arches were of nearly 15′ 4″ in span with a rise of 16″, and were made of two sizes of blocks which were nearly rectangular in cross section and 12″ long in a direction parallel to the skew-back beams, and were respectively 6″ deep for a width of 7′ 8″ across the centre section and 8″ deep for the balance. Shores were placed under the skew-back beams in order to support the beams under the heavy concentration of load. The haunches of the arch were covered with concrete which was so green that the wooden nailing strips were forced down into it so that the platform upon which the brick was piled was forced down, giving a bearing over the entire area of the concrete. The bricks used for loading were computed to weigh 85 pounds per cubic foot.



The first test was made as shown in Fig. 11, and a load of 34,000 pounds was imposed on an area of about 34 square feet. As no

signs of failure were observable, a block of granite 2′ x 2′ x 3′ weighing 2,000 pounds was rolled over and over on the arch from the right-hand beam to the left-hand beam. After this test had been applied, a barrel of cement weighing 315 pounds was dropped endwise from a height of 12 feet, so as to strike near the point of junction between the 8″ and 6″ blocks. The load was then increased to a total of 42,500 pounds. At this point the unloaded side of the arch buckled and rose at the haunches, and the loaded side began to settle; the joints opened, and in thirty minutes the arch collapsed. A length of ten feet or two panels, that subjected to the load and the adjacent one which had been subjected to the impact test, went out.

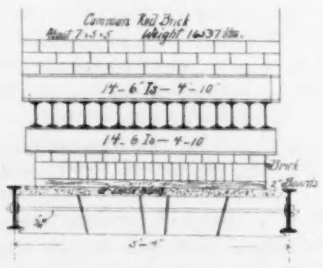
Fig 12



'A second test was made with a load as shown in Fig. 12. In this case the concrete was omitted, and two brick piers, each two feet square, were built up on the arch and were used to support a platform upon which 10,300 pounds of brick were piled. This produced a load of 1,275 pounds per square foot of bearing surface, and gave no signs of failure after having been successfully carried for several hours. It will be observed that in one case the test was carried to destruction, and in the other the verdict was a Scotch one. It will also be observed that the method of placing the tie rods was such as to give but little practical result, and, as a consequence, the full strength of the arch could not be developed. It is also worthy of note that the arch failed in a manner very similar to the failure shown in Fig. 10 under a similar eccentric manner of loading. What the result would have been had the concrete used in Fig. 11 been thoroughly set is of course a mere matter of speculation.'

Porous Terra-Cotta Test End Construction. (38.) (*Engineering Record*, Nov. 17, 1894.) Staten Island Terra-Cotta Lumber Company. This was a test of 9″ porous terra-cotta lumber end construction arches put in with flange protecting skew backs between 10″ beams, and the effective working depth was about 7″ for a span of 5′ 4″. The tie rods were placed about 5′ 3″ apart on centres, thus separating the arches into sections of about twenty-eight square feet of area. The imposition of the load was similar to that shown in Fig. 13, there being first loose sand, then plank-

Fig 13



ing, then bricks, then I beams of varying sizes, and then a large pile of bricks. The deflection was measured by means of a multiplying device, which multiplied the deflection nine times. The loaded area was 20.25 square feet, and on this a load of 21,846 pounds was imposed. The arch was laid up in a mortar composed of one part of domestic cement, one part lime, and three parts sand, and the arches were forty-eight hours old when tested. The static load produced no effect which was visible. An impact test of the usual character was made immediately after the static test, and while the static load remained on the arch. This gave a very slight permanent set, but did not destroy the arch. It will be observed that in the static test care was taken to secure what was practically a uniform distribution of the load, and that the skew backs sustained a shear of 2,400 pounds per lineal foot. Further particulars of tests of this form of arch will be given later.

Henry Maurer & Son. (39.) (Catalogue.) Test made at works of an end pressure hard tile arch similar to Fig. 6 in cross section, but with an additional central web, and with a better form of skew back. This arch was made with a span of 8′ and of a length along the skew-back beam of 5′, and the entire area of the arch was loaded with a pile of brick which weighed approximately 50,000 pounds. This arch was made of blocks 8″ deep, which projected below the bottom flange of the beams so as to reduce the effective depth about 1½″. This load produced no deflection or other visible effect upon the arch, and has been sustained for about one year. Further particulars of tests of this form of arch will be given later on, but it is particularly worthy of note that 5,000 pounds per lineal foot of skew back is being sucessfully carried.

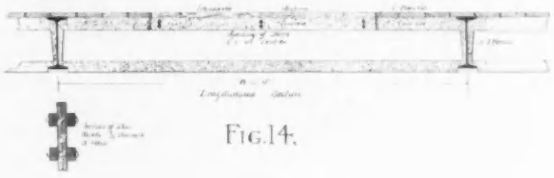


Fig. 14.

Columbia Fire Proofing Company. (40.) (Catalogue.) These arches are built of a combination of concrete and iron as shown on Fig. 14. Tests were made for the patentees by Messrs Ferris, Kaufman & Co. as follows: Slabs of concrete and iron about 3″ thick were built between two 12″ I beams with the top of the slab flush with the top of the I beam; the beams were about 8′ on centres, and the slabs were 6′ long parallel with the beams. The steel bars were placed about 2′ apart on centres, and over the top of the bars chicken netting of 2″ meshes was laid. The concrete was composed of one part Alsen cement, two parts of sand, and three parts of Ligonier screenings. One slab was tested when nine days old by covering the slab with 1″ boards placed parallel with the beams and loading with pig iron. A load of 89 pounds per square foot gave no deflection, 200 pounds per square foot gave a deflection of ¼″, sufficiently great to destroy the future usefulness of the floor. Four hundred pounds per square foot gave a deflection of 2″, while 578 pounds per square foot gave a deflection of 5″. This slab was weakened probably by a premature loading two days before of 200 pounds per square foot, which left the slab with a permanent deflection of ⅛″. A second slab built in a similar manner but of lighter material was tested when thirteen days old by the imposition of a load of 310 pounds per square foot, giving a deflection of ½″ for a span of 6′. A third slab with a span of 8′ with somewhat heavier bars was tested by means of a lever, with a load applied on a space along the centre line of the slab, covering a length of 6′ and a width of 5″. A centrally applied load of 4,867 pounds caused a deflection of ⅛″, which upon its falling accidentally caused a permanent set. It is quite evident that a depth of 3″ for a span of 8′ is such as to lead to an excessive deflection for a moderare fibre strain or a waste of material.

It is also evident from the above that the strength of the construction is largely dependent upon the honesty of the workmanship in putting in the best possible material, and that there is no comparison in strength between this method of floor construction and some of those previously given; while it contains fundamental errors in that it uses an uneconomical section of metal for the steel stiffening members, and insufficient depth to secure rigidity of the floor, which is a prime requisite, has a ceiling construction so light as to be certain to sooner or later sag between the supporting beams, and is dependent entirely on the honesty of the workmen for much of the strength it possesses.

While there are cases where its use would be both wise and economical, it is doubtful if it is of general applicability.

(*To be continued.*)

Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

AMERICAN CEMENT.

III. — *Continued.*

IN the year 1818, twenty-two years after Parker had patented his Roman cement, Canvass White of this country discovered and patented a similar cement found at or near Fayetteville, N. Y.

This cement was used in large quantities in the construction of locks, viaducts, and culverts on the Erie Canal, at that time in the course of construction. Subsequently the State of New York purchased the patent from Mr. White, paying him therefor the sum of $10,000, and made the discovery public property.

In 1824, the year in which Aspdin obtained a patent on his artificial Portland cement, natural cement rock was discovered at Williamsville, Erie County, N. Y., where a manufactory was established. This cement was used extensively in the construction of the locks on the Erie Canal at Lockport, N. Y.

In 1826 natural rock cement was produced at Kensington, Conn., and was continued for several years, the production amounting to about five hundred tons yearly. On account of unfavorable transportation facilities, the production ceased soon after the cements manufactured on the Hudson River were placed in the larger markets.

In 1828 a cement works was established at Rosendale, Ulster County, N. Y. The product of the factory was first used in the construction of the Delaware and Hudson Canal, then being built through the town of Rosendale.

Other cement works soon followed at this place. Owing to the general good quality of the cement rock, and its proximity to New York City, as well as the advantages afforded by cheap transportation on the Hudson River, this locality rapidly developed into the leading natural rock cement centre of this country, a position it maintains to the present day. Its yearly production amounts to about two and three fourths million barrels.

In the year 1829 cement rock was discovered at Louisville, Ky., while excavations were being made for the Louisville and Portland Canal, and it was manufactured and used during that year in the canal walls and locks.

Here again the rock proved to be of excellent quality. This fact, taken in connection with the conveniences in the matter of transportation on the Ohio River, and the advantages resulting from a wide and uncontested field of trade, led to the rapid introduction of this cement, and made the locality the centre of the cement industry beyond the Alleghenies, and in some seasons the production has been as great as 1¾ millions barrels, and is exceeded only by the production from the Rosendale district.

During the summer of 1831 excavations were made for a canal on the left bank of the Susquehanna River to connect Muncy and Lock Haven, Penn., at a point about ten miles west of Williamsport on land known then and now as "King's Farm." The excavations disclosed an enormous body of rock, which was ascertained by Mr. Robert Farries, chief engineer of the canal, to be hydraulic cement rock. Col. George Crane, a prominent man of his time, living in a stately brick mansion across the river directly opposite "King's Farm," was a contractor on the canal at the time, and he at once set about constructing a cement works for the manufacture of cement from this deposit for use in the construction of the canal. He built five kilns with suitable facilities for grinding, and his cement was used in the construction of the locks, bridges, culverts, dams, and viaducts, the latter in some places being over three hundred feet in length.

When the canal was finished in 1834, the manufacture of the cement was discontinued, but the condition of the work, done over sixty years ago, with the product of this somewhat primitive plant, gives promise to-day that the rocks themselves will endure no longer than the material which binds them together.

In 1836 the Cumberland Hydraulic Cement and Manufacturing Company established a natural rock cement works at Cumberland, Md., which has since been in continuous and successful operation. As a result of the excellent quality of this rock, other works were subsequently erected, and the yearly output has been large, and the Cumberland cement bears a most excellent reputation.

In 1837 cement rock was discovered at Round Top on the left bank of the Potomac River, near Hancock, Md., by A. B. McFarlan, a contractor of Washington, D. C., and the following year he manufactured cement from this rock, and used it in the construction of the Chesapeake and Ohio Canal. The graceful viaducts along the line of this canal, with the mortar unimpaired, attest the enduring qualities of Round Top cement.

It was during 1838 that cement rock was discovered at Utica, Ill., and works were erected during that year by Norton & Steele to supply cement for the construction of the locks, culverts, and bridges of the Illinois and Michigan Canal, and the rock proving to be of most excellent quality, the manufacture since that time has been uninterrupted.

In 1845 this plant passed into the possession of Mr. James Clark of Utica, Ill., and has been operated by him until 1888, at which time it was incorporated as the Utica Hydraulic Cement Company, and its capacity largely increased. This cement has always stood well in public favor. In the masonry laid with it over fifty-five years ago, the joints are as hard to-day as the stone itself.

In 1839 natural rock cement was first produced at Akron, N. Y. The rock proving of exceptionally fine quality, its manufacture has been continuous, and steadily increasing in volume. Some of the most important engineering works of the country have been constructed with it, and its enduring character is well established.

In 1848 cement works were established at Balcony Falls, Va., by O. H. Locher; the works are known as the James River Cement Works. O. H. Locher & Co. are still the proprietors at Holcomb's Rock, Va. The cement from these works has always borne an excellent reputation.

In 1850 cement rock was found at Siegfried's Bridge in the Lehigh Valley, Penn., and cement was produced and used in the construction of the Lehigh Coal and Navigation Company Canal from Easton to Mauch Chunk. Its manufacture has been continuous, and has assumed large proportions, with a constantly increasing demand.

In 1850 cement rock was discovered at Cement, Ga., by Rev. Chas. W. Howard of Charleston, S. C, and the eminent chemist, St. Julien Ravenel, also of Charleston (and a personal friend of Prof. Agassiz), who analyzed the rock, found it to be of a high quality; and its manufacture was commenced by Mr. Howard and his son in the following year, and was prosecuted by them until the beginning of the late war, when they both volunteered in the Confederate service, and the cement factory was allowed to fall into disuse.

In 1867 Col. George H. Waring, then of Savannah, Ga., purchased the property, and again the plant was put in running condition, and has since been operated continuously as the Howard Hydraulic Cement Company, Geo. H. Waring, president.

The cement manufactured by this company probably has no superior in this or any other country. Used as an exterior plaster in 1852 by Dr. Ravenel on his house in Charleston, situated on the Battery, where the walls are exposed to the disintegrating influences of salt spray, the stucco still remains unimpaired, while the sandstone lintels of the windows have long since been worn away.

In 1867 hydraulic cement rock was first discovered at Fort Scott, Kan., and its manufacture was commenced in the following year, and since that time has been continued uninterruptedly, the works having, for several years, been controlled and operated by the C. A. Brockett Cement Company, of Kansas City, Mo. This

company has some local advantages not enjoyed by others. An excellent vein of coal underlies the cement rock, being separated from it by a stratum of fine fire clay. This coal is used in the manufacture of the cement, which in its general characteristics greatly resembles that of Cement, Ga.

URIAH CUMMINGS.

(*To be continued.*)

ADULTERATION OF PORTLAND CEMENTS.

WHEN we hear from one of the largest English manufacturers that a number of the English Portland cement works "are largely adulterating their manufacture by the mixture of Kentish ragstone, other stone, furnace or oven ashes, disused or exhausted firebrick, or other inert material, and so bringing disrepute upon the good name of English cement," and when we learn, as was the case with some Portland cement recently received at New York from one of the Continental factories, that it was largely adulterated with ordinary river sand, we find that the European manufacturers of Portland cement are taking advantage of the lack of testing by the engineers and architects of this country, and are shipping cement here composed of sand, ashes, etc., which sell to the unsuspecting person for first-class material.

It is possible that even such a composition may be strong enough for the purpose it is used, still as it is sold as and plainly marked "Portland cement," its sale is a fraud and cheat on the American people. The engineering and architectural professions have brought this upon themselves. With pure Portland cement made at several places in the eastern part of the United States equal in every respect to the best Portland cement made in Europe (government, municipal, and private tests, covering twenty years, prove this to be a fact which cannot be successfully disputed[1]), for some American engineers and architects to specify simply "English Portland," or "German Portland," without any requirements for strength, fineness, etc., has only been an invitation to fraud, and the wonder is that it was not perpetrated long before this.

Mr. Leedham White, in his address at the meeting held in London to form an association to prevent the adulteration of English cement, says, in reference to the rule of the German Society of Cement Manufacturers, permitting the use of two per cent of adulteration in making Portland cement: "I myself am in favor of the latitude of, say, two per cent, no more, no less. I am in favor of going to the length of two per cent, because that would give sufficient latitude, as far as my knowledge goes, to the importation of a small and innocuous quantity of other ingredients which improve Portland cement in one of its several qualities." The adulteration, above referred to, is the addition of small quantities of sulphate of lime to the Portland cement, which seems to give the cement that particular quality of setting slow (by retarding the chemical action for a short time) and hardening quickly.

Whether this is as desirable a result as it first appears, considering the nature of the adulterant, is a question now under investigation by some of our prominent chemists and manufacturers. That it is especially desirable that the quantity of sulphate of lime should be kept as small as possible in all cement to be used in sea water is a recognized fact. In Europe some of the governments permit the use of cement treated with sulphate of lime to be used in work on land and in fresh water, but for sea work the specifications are so drawn as to exclude the use of such treated cements.

Mr. Frederick H. Lewis, of the firm of Booth, Garrett & Blair, in his valuable paper on Cement Specifications, read and discussed before the Philadelphia Engineers' Club, Dec. 1, 1894, says: "As a rule, the cements which mature rapidly are treated cements, and it seems to me that this rapid hardening, producing a brittle, glass-like texture, was a disadvantage and sacrificed that valuable property of Portland cements by which they continue to gain strength and hardness through several years time."

Mr. Lewis submitted some tables showing the tests on different cements treated with different percentages of sulphate of lime. They all showed that from one to two per cent added to the cement increased its tensile strength at seven days from 25 to 60 per cent, but a larger quantity than two per cent very materially weakened the cement. Unfortunately the tests given were not carried out beyond the seven days' test. Mr. Lewis, although stating that this treating a cement with sulphate of lime made it brittle, glass-like, etc., yet further on says that it seems to him that the peculiar combination of setting slowly and hardening quickly might be a valuable one in cement mortar under some circumstances, but says: "It is entirely clear, from the tables submitted, that the addition of sulphate can be easily overdone and an amount added which will make the cement not only bad, but dangerous. Hence, I think that there is no matter of greater importance than the regulation of this sulphate. There is no doubt, in my mind, that foreign cements have been sold in this country after treatment, which could not be sold in Europe where tests and specifications are better looked after."

Now, in view of this information and the fact that all the best German cements on this market are made by members of the German Society of Cement Manufacturers, and the fact that a large percentage and, it is generally believed, all of their cements are treated with sulphate of lime, an engineer or architect using German cement on his work, which has not been thoroughly tested, has no absolute security that the cement does not contain the element of its own destruction, notwithstanding the statement in this journal several months ago, that "an engineer may be at ease when his work is being done with these standard cements."

WM. G. HARTRANFT.

PHILADADELPHIA, PA., March 1, 1895.

EDITOR OF THE BRICKBUILDER:

Replying to my kindly critics, Messrs. Hartranft and Sabin, I may say, in regard to the former's remarks, that I agree with him that *weight* has much to do with the quality of cement, but weight without necessary fineness is a factor rather to be feared than embraced. The product of a heavy "clinker" is enhanced in value almost in arithmetical progression, as its fineness is doubled after reaching a certain standard. A finely ground, imperfect clinker makes a better cement than a well-burned one coarsely ground, within resonable limits. It is quite true that of two samples of cement, fineness being equal, the heavier is the better product.

In important works the specification for Portland cement should embody both a fineness and a weight test; this will insure a uniformity of strength and quality, which ought to obtain in all extensive works.

These values of weight and fineness may be regulated to suit the character of work in hand, the more important commanding the higher and more costly grades.

Replying to Mr. Sabin, most English engineers and architects now adopt a "standard" for general work of one hundred and ten pounds to the "striked" imperial bushel, one thousand six hundred fine. I have before me the works of Grant, Faija, Mann, Newman, Reid, Gilmore, Thurston, Kidder, and a dozen other English and foreign authorities, besides some twenty years of "The Doings of Franklin Institute," and many papers read before the architectural and engineering societies of Great Britain, the United States and Canada, and from a fair examination of the "test" results given, to which is added my own experience, I am satisfied that for general purposes an allowance of two hundred and fifty pound is ample for the average cements, if a fair margin of safety is provided.

Of course I am aware that tests have been made showing astonishing results, some as high as twelve hundred pounds, but these are rare exceptions. I believe American manufacturers can provide a cement that will test much higher than that if necessary; they are only limited by cost.

[1] The writer will cheerfully furnish data on this subject to any one sending his address to 305 Girard Building, Philadelphia.

As a matter of general usage (and good sense), cement that has once set should be discarded if strength is desired, *unless in the hands of an expert*, and Mr. Sabin evidently knows the reason why, for he hints as much.

I do not withdraw my statement anent quick-setting cements under water. Of course Mr. Sabin will understand, if the conditions are not favorable, the engineers will adopt the cement most suitable to the purpose, but I maintain a slow cement is best for submerged work, where conditions are favorable.

With regard to the expression, "the hardest burned and finest ground being the heaviest," I must confess it is somewhat "hazy." In looking over my memorandum, I find it written "best" instead of "heaviest." This would round up the sentence and be more in accordance with facts.

Yours,

FRED T. HODGSON.

COLLINGWOOD, ONT., March 11, 1895.

VARIOUS SYSTEMS OF CONCRETE CONSTRUCTION.

SO much is being said of late about concrete and its uses, that the writer proposes, in subsequent papers, to describe some methods and processes for the handling of concrete in various forms of construction.

Concrete has come to be recognized as a building material eminently suitable for foundations of all kinds, and for such works as require great strength and massiveness, and particularly for work under ground and under water.

It has come into almost universal use for massive work in dams, wharves, bridge piers, fortifications, and works of the greatest importance; no doubt whatever exists of its superiority to all other materials in this line of work.

In some places it is used out of ground and water, — in canal walls and locks, in docks and wharves, and in buildings; while in other places it has been used to displace brick and stone work in the most delicate of ornamental mouldings and ornament.

The development of concrete in its many fields has not been carried on in one locality, so that we do not find instances of the use of concrete in its fullest extent in any one place; but if we assemble the evidence, we find that there is no shadow of a doubt that concrete may displace all other building material, both in massive masonry and in ornamental work, in underground work, in exterior construction, and in any climate. In the coldest sections of this country we find concrete used in pavement work, where it must not only endure the action of weather, but also the wear and tear of constant heavy traffic in addition, and the evidence is overwhelming that no other material known endures so well. Is it not reasonable to suppose that if a piece of concrete will stand climate and wear and tear in pavements, that the same concrete will stand the climate alone, when set up in a wall? As a matter of fact, this has been conclusively demonstrated in wall construction all over the world, and in delicate ornamental work in many cities where the climate is most destructive.

Now if we assemble the evidence that may readily be gathered, the conclusion is irrefutable that concrete buildings and structures of all kinds can be built in the coldest sections of the country, and particularly in New England.

Successful work, however, depends wholly on a thorough technical knowledge of the properties of concrete, and its behavior under all conditions. This knowledge is essential for the proper design and calculation of strains in concrete structures.

Again, a thorough understanding of the manufacture of concrete is essential, and an acquaintance of existing methods, and ways, and means for handling the material in the most economical manner. This knowledge is necessary that the work may be done as cheaply as similar work in brick and stone. The writer, therefore, desires, in subsequent papers, to show how concrete may be handled, and to describe various processes by which the best results may be obtained, both by the material alone, and by using it in conjunction with other materials. Thus it may be made in such a way that it will, in appearance and strength, equal stone. | It may be united with iron in such a way as to displace steel in beams and girders.

Wall loads may be assembled on to concrete piers and buildings, built wholly of concrete, that, from an engineering point of view, are similar to the skeleton-frame buildings of Chicago.

The subsequent papers will not confine themselves to one system, but to all methods in use, which involve concrete and its uses either alone or in combination with other materials. The writer will be glad to receive descriptions or processes and methods with which he is unacquainted, with a view of presenting them on their merits and adding them to the general fund of knowledge of concrete and its uses.

It is to be understood that these papers are to be wholly impartial, and not, in any respect, to be regarded as an advertisement. Nothing will be printed which, in the writer's estimation, does not possess genuine practical value from an engineering standpoint, or add materially to our knowledge of concrete and its manufacture and use.

It is not the writer's purpose to confine himself to building construction, but to describe methods of using concrete in other structures and for other purposes, as in pipe and conduit laying, subways, tunnels, and the like.

Until comparatively recent times, concrete has been used in conjunction with other materials merely as a filling between supports or bearers. In floor construction the loads were carried by steel beams of various sections, and the concrete then arched in between, or used as slabs to fill the intervening space.

It has been shown, however, in more recent times, how perfectly the strength of steel bars, rods, chain, and netting of various kinds may be so incorporated with the concrete as to impart to it practically the whole working value of the concrete. The use of netting has been extensively used in Europe in the Monier system, and numberless works of importance — bridges, arches, and domes — have been constructed in this fashion. The use of rods with washers and other forms of hold,— Ransome, Hyatt, Jackson, — to prevent slipping, are common, and a good deal has been done with chain — Jenkins — of various kinds to give greater tenacity to masses of concrete.

One of the most clever and satisfactory methods of producing a perfect bond between concrete and iron is simply to embed square, twisted rods in the concrete in that part of the mass that is most subjected to tensile or pulling strains.

The effect of the twisting of the square bar is obviously to form a series of spirals along the bar, similar to the threads of a screw. The concrete embeds itself around the rod at every point, precisely as the thread of a screw is surrounded by the wood fibres. The result is that in order to produce a separation between the concrete and the iron there must be sufficient force exerted to shear the concrete spirals at every point, and this, within the ordinary limits of the material, is impossible. The question is asked immediately, "What effect does the twisting produce in the strength of the bar?" A long series of tests has proven conclusively that if a bar of iron is twisted cold, the iron is strengthened from fifteen to forty per cent.

The following tests, made at the University of California, are one set of a long series in which the evidence is always the same:—

TABLE I.

The tests were made on the Riehle Brothers testing machine; the iron furnished consisted of ¾ square rod, which were cut into lengths of 12 inches, with the reduced part 4 inches long and ½ inch in diameter, and were given ¼ twist per inch (or the specimen was twisted 720°).

Generally specimens were tested immediately after twisting, but those that were submitted to the test 5 days after twisting, as suggested by Prof. Hesse, gave better results, as will be seen in the following tables.

Averaging all the results, the cold twisted, broken 5 days after twisting, gives 53.3 per cent better result than the straight specimen.

The cold twisted, broken immediately after twisting, 38.5 per cent gain, while the hot twisted shows a loss of 5.5 per cent.

TESTS MADE OCTOBER 26, 1889.

Specimens one foot long from $\frac{5}{8}$ inches square, wrought iron.

Specimen	Description.	Diameter.		Length.		Area in Square Inches.	Max. Load or Tensile Strength.	Tensile Strength per Square inch.
		Before Breaking.	After Breaking.	Before Breaking.	After Breaking.			
	Cold Twisted, 5 days before			Inches.		Inches.	Pounds.	Pounds.
1	breaking.	.5	.493	4	4.468	.1963	13170	67193.9
2	"	.5	.495	4	4.437	.1963	13260	67653.0
3	Cold Twisted.	.5	.497	4	4.375	.1963	11920	60816.3
4	" "	.5	.496	4	4.415	.1963	11920	60816.3
5	Hot Twisted.	.5	.467	4	4.062	.1963	8340	42551.0
6	" "	.5	.490	4	4.625	.1963	8040	41020.4
7	Straight.	.496	.453	4	4.968	.1932	8545	44222.7
8	"	.5	.456	4	5.50	.1963	8510	43418.4

A simple method of showing the efficacy of this twisting, as regards strengthening the bar, is to take a square bar, five or six feet long, and twist half of it, the bar being cold. Break the bar in a testing machine, and it will be found that the fracture will always take place in the untwisted portion.

The application of this principle of uniting the two materials has been widely developed, and is meeting with such favor that a full account of the system will require more space than can be given at this time. In a subsequent article it is proposed to demonstrate the theory by which these two materials may be best used together, and to give an account of some of the principal applications of the principles involved.

Ross F. Tucker.

MORTAR COLORS AND MOULDY BRICKS.

IT is claimed that the Phœnicians and the early Egyptians used mortar coloring, but this is evidently without foundation. The Pyramids were erected of blocks placed upon each other without any cement, and those buildings on which cement was used were erected by the aid of hydraulic cement which turned black with age. The first record of coloring mortar is only a few centuries back, and originated in England where a red color was used, called Spanish brown. This color has been used largely in America, and its strength varies so much, and its composition is so coarse, that it is practically unfit for the purpose. Fancy coloring for mortar is really only about eleven years old. In 1884 Toch Brothers, of New York City, first imported a ferric oxide, which was nearly pure, and they sold it to several builders who wanted a permanent and uniform joint on the buildings they erected. Later a demand arose for colors other than red, and in a short time fancy colors were gotten up for this purpose, which have evidently come to stay. It is generally believed, however, that anything which contains color will do for coloring mortar, but this is a great mistake. Mortar is highly alkaline and caustic in its effect, and only a certain grade of color or a color containing a high percentage of ferric oxide will answer the purpose; and ferrous oxide, if it be one hundred per cent pure, is also absolutely unfit for mortar coloring. An organic color, no matter what its strength or price may be, is valueless for this purpose. Some builders use a Venetian red, but this is not a good color, as it contains very rarely over twenty per cent ferric oxide, the balance being calcium sulphate, commercially known as plaster of Paris. The process of the hardening of lime and sand is well known, but it is not amiss to go over this subject for further reference; the lime absorbs carbonic acid from the air and forms carbonate of lime, which is chemically the same as marble. This substance artificially will outlast a poor quality of brick; and if color be mixed with the lime which is so weak that it takes a large quantity to produce the desired shade, the bond is interfered with, and the joint is weak. Some qualities of lime contain a little free salt, and some contain a little sulphate of calcium, or plaster, due to the coal used in burning it. After a building is erected, whether mortar color has been used or not, white mouldy spots appear, sometimes on the joint, and sometimes on the brick, and so many causes have been assigned to this, that it is positively interesting to read the conjectures of the uninitiated. Many claim that it is an exudation of plaster; more claim that it is salt; and a few claim that it is chloride of calcium. It might be salt, and it might be plaster, but it is not generally either. If some of the white excrescence on a joint or on a brick be scraped together and analyzed, the spectroscope will show that it is largely composed of sodium and calcium, and a further analysis will reveal that the acid combination is hydrochloric acid. The air on the seacoast is so highly impregnated with salt that a lime can contain quite a percentage of it and the bricks can absorb a great deal more and give it out again in dry weather. If calcium chloride be present, it may be either originally in the lime or it is more often produced by washing down the front with muriatic acid, and the presence of calcium chloride is not so easily destroyed. Calcium chloride is a hygroscopic salt which can be partially destroyed, and in some cases entirely so, by washing down the front with diluted nitric acid. This forms a calcium nitrate which the rain will carry away completely. Where muriatic acid is used as a front wash, the combination of chloride and calcium is bound to occur, and once chloride of calcium is largely present, it being continually moist, forms a nucleus or a medium for the propagation of the germ of mildew (*penicillium glaucum*).

Maximilian Toch.

SINGULAR PASSAGE OF A SCREW STEAMER FROM THE TYNE.

A RATHER curious passage of a screw steamer has just been brought under our notice. The vessel in question is the "Tyne Queen," which recently left this river on a voyage to Drontheim. When off the Norwegian coast she experienced the heavy weather which lately prevailed in the North Sea, during which she pitched to such an extent that she struck the rocks in seven fathoms water. As she did not seem to have received any injury, and made no water, the voyage was prosecuted to Drontheim in the ordinary way, where she loaded a cargo of sulphur pyrites, and sailed again for the Tyne. After discharging here it was deemed better to have a look at her bottom, and on taking her into the Graving Dock at Jarrow she was inspected by the surveyors of the Liverpool underwriters, who found that she had broken her keel, as well as some of her plating, besides starting a considerable portion of her riveting to a serious extent. The wonder then grew, how a vessel in this state had been navigated throughout the greater part of a tolerably long voyage without having given the slightest trouble to anybody. A closer inspection showed that the cement, with which the bottoms of most screw steamers are covered, had actually withstood the thumping which she had endured off the Norwegian coast, and that its unbroken skin had, for the time, done the work of iron plate! The vessel is still in the Jarrow Graving Dock. The Portland cement used in lining the "Tyne Queen" was manufactured by I. C. Johnson & Co., works at Gateshead-on-Tyne.

THE Vulcanite Portland Cement Company of Vulcanite, N. J., will begin the manufacture of cement on April 1, 1895. They will use the rotary cylinder process, same as the Whittaker Cement Company use. Any correspondence can be addressed to A. B. Bonneville, vice-president and manager, Siegfried, Pa.

The Mason Contractors' Department.

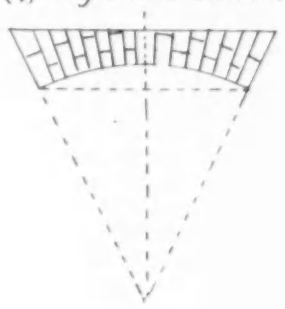
Conducted in the Interests of the Builder and the Contractor for Brickwork.

ORNAMENTAL BRICK ARCHES.

(*Continued.*)

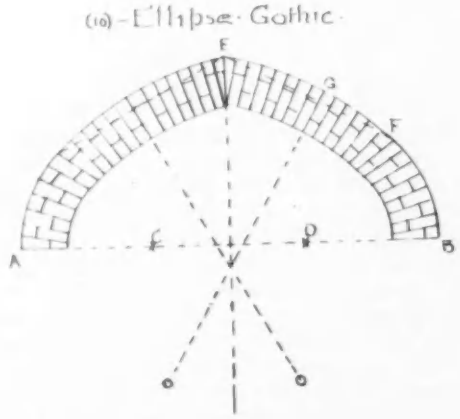
Segment Camber. — The segment camber is somewhat like the camber arch, and is constructed with much less labor and looks well in a building. Lay out the height of the arch as required on the perpendicular line (see Fig. 9), and draw a line parallel to the span of the arch, and intersect it with the line of the skew back drawn from the centre. Lay the courses out the same as in the camber, and it is only necessary to cut for the beds and the upper line of the arch.

(9) Segmental Camber

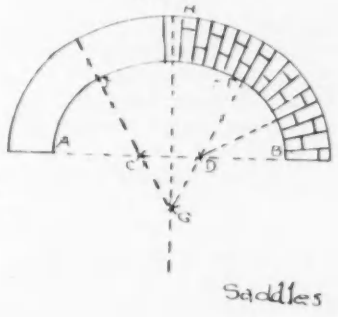


The ellipse Gothic is rather more difficult in the working than the general run of Gothic arches, owing to the different striking points. To draw this arch (see Fig. 10), let the distance *A B* be set off equally on each side of the perpendicular line, then divide it into four equal parts by marking the points *C D*, and with *D* as centre and the distance *A B* as radius, describe the arc from *B* to *E*, mark the point *B E*, equal with *B D*, draw the chord *F E*, and bisect it at *G*, from which point draw a line with the set square from any point *O*, and upon this line the centre is taken to draw the upper portion of that part of the arch as shown: the soffit curves are obtained in the same way. After the lines *A F E B* are drawn, they can be made to answer either for soffit or extrados by striking the other parts *greater* or *less* than those named, but the centre will do for either. The moulds for this arch are taken in the same manner as those in the *camber;* that is, it must be traced over with the moulds so that each course shall be *exactly* of one *size*, and the bevels must be taken separately. It is of the greatest importance that the mechanic should practise drawing this arch until he is thoroughly acquainted with every part; for *ellipse* Gothic, or Tudor arch, or *four centred* vary greatly, and by thoroughly understanding the principles of the one here described, he will be better able to reduce or elevate them to suit his requirements. The construction of this arch is slurred over more than any other we are apt to see, the mechanic forming two moulds to construct each side of the arch, which should *never* be done when the appearance of the arch is taken into consideration; and where great exactness in workmanship is required in ellipse Gothic or any other form of arch, whether of stone or brick, the mason should set out the full size of the arch in elevation on a drawing, with the joints, soffit, and extrados lines marked thereon. Lay the full size of drawing on a thin sheet of zinc, prick through the lines with a fine point into the zinc to the form of the required bricks, and then cut them to their requisite shape, being numbered for their respective positions in the arch; they can then be applied to the brick to be worked, and when they are formed they should be marked or numbered also, and when setting the arch the above drawing should be at hand and each course placed as correspondingly marked on this drawing.

(10) - Ellipse Gothic

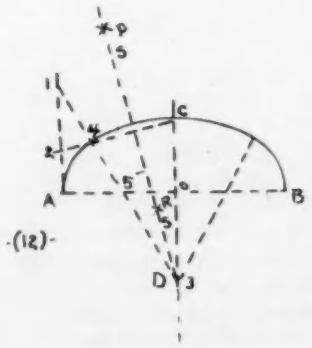


(11) - Semi-Ellipse Arch



Semi-ellipse arch (Fig. 11), which is somewhat like the ellipse Gothic, the difference being in their crowns; but the drawing is quite different. In drawing this arch divide the span into three equal parts as shown at *A*, *C*, *D*, and *B*, then with *D* as centre, and *D B* as radius describe the arc from *B* to *E*, equal to *D E*, and the same on the opposite side to *F*; then with *D* for centre, and the distance *D C* for radius, describe an arc, cutting the perpendicular line in *G*, and from this point with the distance *G F* describe the crown *F E*; the outer curves are taken from the same centres, only with a greater radius. To get the moulds correctly, that is for ornamental brickwork, where all the brick should be of the same size, this arch must be traced over in the same way as the camber and ellipse Gothic, that is, take the thickness of the brick, and set it equally on each side of the centre line at *C*, then draw the lines to *G*; this will give the size of the

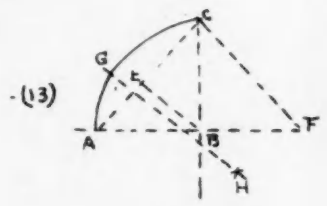
(12)



mould very nearly; then if they are worked alternately down to the springing line, it will easily be seen where they want easing. There is no doubt but what these arches are stronger in every case when they are built from their centring lines, and is the easiest method; but the appearance is not so good as when the courses in the arch are all of the same size, and for face-brick work their stability is sufficient for the amount of weight they have to bear.

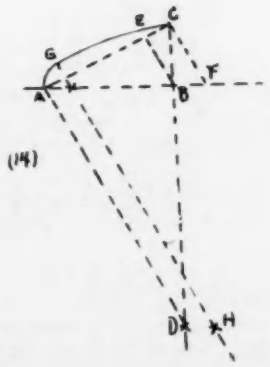
The adjoining mode (Fig. 12) is probably the closest approximation that can be arrived at in showing the true ellipse by the compasses or from centres, which I know will be useful for the mason to understand. To draw it erect the perpendicular line *A* 1 at right angles to the conjugate axis, and make it equal to *O C*. Divide *A* 1 into two equal parts, and draw the dotted lines 2 *C* and 1, 3, describe the arcs *J R* from the centres 4 and *C*. Draw the line *S S* until it cuts the continued transverse axis at *D*, this being the centre of the larger curve of the ellipse 4 *C T*. Next draw the line 1 *D*, and where it cuts the conjugate axis at 5 is the centre of the end curves of the figure. The foregoing is probably the most ingenious method of drawing the ellipse by the compasses or by centres that has yet been discovered.

The necessity for taking the face moulds for brick or stone arches constructed from ellipse curve from the full-sized drawings of the arch arises from the fact that these arches are generally *crippled* at the junction of the small and large curves *T*, and they should be nicely arranged in this respect by the mechanic: also that all the face moulds of the arch should be exactly alike, especially for ornamental brickwork or masonry.



To draw arches whose height is greater than their half width.— (Fig. 13.) For arches whose height is greater than their half width draw *C F* and *B E* perpendicular to *A C*, then *E C* will be the smaller radius, and *E C* added to *C E* will be the longer radius *H*.

To draw an arch less in length than its half width. — The following plan has been put forward for finding the curves of arches and *ribs*. The fundamental rule that the curves should spring from the line of the impost has been abandoned by many. The following rule furnishes a principle which gives the centres of all these curves with



perfect certainty and perfect harmony, at the same time furnishing what is further requisite, an independent projection for each rib: if the arch to be drawn be less in height than the half width, let *A B* (Fig. 14) be the half width; *B C* the height; join *A C*; draw lines from *B* and *A* perpendicular to *A* and *C*, and the points *E D* are thus required. Then *E C* will be the smaller radius, and *E C* added to *A D* will be the longer radius, *H*.

Saddles. — Where two or more arches are set close together, saddles ought to be cut as shown in Fig. 15, and not a continued straight joint; for although this is often done, there is no bond between the two arches. In the same cut is shown the manner in which ornamental Gothic arches are "keyed" when red, black, buff, or white brick are used to build them, as well their disposition when tuck pointed for ornamental work, and the straight-jointed key where strength is desired instead of ornament.

The various forms and designs of the arch are of an almost endless description, and as practised in various countries form a most interesting study for the mechanic; but I trust I have described enough to answer the practical mason, and to further his knowledge and examination of higher principles of arching, which are founded on the unerring laws of geometry and proportion.

ARCHIE.

EDITOR OF THE BRICKBUILDER:

Dear Sir, — I was very much interested in the article by Mr. Cram on "The Use of Brick in Domestic Architecture," and would be glad to have him go more into details of construction. As, for instance, how did they tie the two walls together? Iron ties or brick laid across air space? If the former, would the two four-inch walls have sufficient rigidity, or if the latter, would dampness not show on plastered wall? In fact, can a wall of that character (two four-inch walls with two-inch air space between) be depended on to keep dampness out where plaster is placed on the brick?

I have never built a wall of that character, furring is the usual practice here; but if it can be vouched for as all right and sufficient, would like to try it on a small brick cottage I expect to erect for myself. I understand that the dampness is not from moisture in the brick, as is popularly supposed, and have always had my doubts about the efficiency of damp check close to grade line, as I do not think dampness will rise in brickwork to any appreciable degree. The moisture usually showing on a plastered brick wall is deposited on the wall on account of the difference in the temperature of the wall and the air of the room. Now whether the English houses, shown by Mr. Cram, are free from this trouble, by reason of the air space, is what I would like to know.

I would like to see your "Mason Contractor" department made a practical one, with correspondence from men engaged in the business in relation to their work. I would like to contribute to it myself if you would allow me, and tell my brother builders how I built a smoke-stack, the apparatus I used for hoisting material, etc.; would also like you to show (if not already done) detached brick residences suitable for forty-foot lots.

Respectfully yours,

A. H. COPE,
Contracting Brick Layer, Decatur, Ill.

[The columns of this department will be always open to our mason contractor subscribers, and we extend to them a cordial invitation to make free use of this medium through which to discuss all questions that may be of practical value in their business. — ED.]

THE MANUFACTURER.

DANGER SIGNALS.

A PAPER READ AT THE CONVENTION OF THE NATIONAL BRICK MANUFACTURERS ASSOCIATION, BY ROBERT W. LYLE.

FOR years I have endeavored to figure out why it is that people of intellect, after gazing upon the different branches of the clay industry, immediately conclude that they can do it as well as the most experienced clay manipulator. It is not so of other industries. The novice watches the potter throwing upon his wheel the jug or jar. He concludes it a lead pipe — a cinch — to do the same thing. Watchmaking, manufacture of shoes, or any other industry is never sized up in such a manner. As a matter of fact, any other industry is easier to learn than the potter's art. There must be something in the clay which operates upon the brains of such people. Did you ever notice it? Think it over.

The same may be said with regard to brick burning. While it is true that a person who burns brick is one that shovels coal, I should hesitate before placing my kilns in charge of a man who has no other accomplishment than the wielding of a shovel. I believe a danger signal should be hung out at this point.

Should a professional brick burner offer his services, the man who wears kid gloves and boards at first-class hotels, the red light, the danger signal, should be set out and caution be the watchword. You will find theory is his only stock in trade, — watered stock, emphatically.

A successful brick manufacturer should possess a thorough knowledge of the many burning processes, the construction of kilns, and fully comprehend all stages of brick burning. If this is impossible, he should have judgment enough to secure a thoroughly competent man to take charge of this most important part of his business. You will remember the old saying, that

> "He who would by ploughing thrive,
> Must either hold himself or drive."

This is true in the relation of manufacturing and burning of brick.

The most successful brick manufacturer is one who can take off his coat and handle any portion of the business. It is most difficult to delegate to laborers the requisite knowledge of the proper handling of machinery and clay. Without such practical experience, the brickmaker is of little use, no matter how well he understands his business theoretically.

There has been no industry in this country that for the last fifty years, proportionate to the amount of capital invested, has met with more failures than the clay-working industry, this state of affairs being brought about by the attempts of men inexperienced in the art, and is also largely due to the attempts of inventors to get up improved methods of brick moulding and new machinery of every description, having made success with their machinery in certain grades of clay, having advertised it extensively, and having claimed infallibility in that their machines would make brick out of any kind of clay, under any reasonable circumstances, and in a marvellous manner.

This often causes the inexperienced capitalist to put in his money and urge his friends to put in theirs. They see the success of the industry as compared under favorable circumstances, and take it for granted the same conditions can be attained wherever and whenever they choose.

TERRA-COTTA DETAILS USED IN THE PETER DOELGER BREWERY BUILDING, NEW YORK CITY.

EXECUTED BY THE GLEN'S FALLS TERRA-COTTA CO.

The machinery which might make brick suitable for some markets, under certain conditions, and with certain clays, would, in fact, be utterly worthless to manipulate clay mined in other localities. Danger signals should be hung thick around all such inventors and enterprises. Men seeking investments in clay-manufacturing directions should make haste slowly. Several acres of clay can be found out of doors in many directions. I can name several localities where millions of dollars have been irretrievably lost in the manner just alluded to. Capitalists seeking investments in clay manufacturing directions should always send samples of clay to be tested in various ways, selecting reliable brick machine manufacturers for that purpose, but never should the slightest confidence be placed upon chemical analysis. Here is where I hang out the most prominent danger signal. The scientist who claims to tell you all about your clay, what it will do and what it will make, is a humbug of the first water. He would be useful if the manufacture of chemicals, or drugs, was contemplated. There is no test in the world of value whatsoever, except the actual fire or burning test. We all know black clay will burn white, and white clay black.

In a word, I have no more faith in a chemist's analysis of clay than I have in the Irishman's definition of metaphysics. Pat was asked the meaning of the word, and replied: "Well, I meet yez on the street and I tell yez something I don't know, and yez don't know either. That's metaphysics."

Take two bricks exactly the same as to material; burn one in a muffle kiln, the other in an open kiln; examine them, and ask yourself if chemical analysis will determine such a result. The burning of small samples in small kilns, the samples being manipulated by hand, is of little practical value. Some clay will work satisfactorily under the soft-mud process, while it will prove absolutely worthless under the dry-press method. Here is another danger.

I have in mind a gentleman who purchased clay property. The samples were made by hand and proved satisfactory. He erected his works, spending fifty thousand dollars, and up to this date has not produced a full-sized brick of salable quality.

It is not always the safest thing to rely upon samples made by a firm or a manufacturer interested in the sale of a particular kind of machinery. If he is a shrewd man and has an eye to business, it is to his interest to make and burn a few samples and forward to you fine specimens, to the end that his machinery may be purchased. He will not hesitate to adopt any method of treating the clay, so long as satisfactory samples are produced. His methods might, or might not, be practical to engage in extensively. This is a danger which I signal most forcibly.

The selection of proper machinery first, and the erection of proper kilns second, seem to me to be the foundation of success. In my travels I have seen enough rejected and useless brick machinery to cover a ten-acre lot. The smooth, oily-tongued salesman induces the man, who has money to burn, to purchase his brick machinery, showing beautiful photos or cuts of the same, guaranteeing almost anything and everything. You will agree with me this is a rock upon which many a concern has been wrecked.

After examining most carefully hundreds of kilns, I am convinced that the down draft process of burning is the only suitable and economical method. With the up-draft process of burning, the tendency of heat to rise and cold air to follow, contracting the heated current as

it rises, drawing in the cold from the side as it goes up, is fully in accordance with nature's laws; but it does not attain that which is desired in utilizing the products of combustion inside the kiln, and is consequently much more costly than the down-draft process.

Where the heat has a downward tendency, it is much easier to cause it to spread to all portions of the kiln, and it is then enabled much better to do the work satisfactorily.

The continuous kiln, in my opinion, has come to stay. The lateral draft of the heat is much more fully and economically utilized, owing to the fact that the heat can pass continuously through the different compartments, until it reaches a compartment at such a distance that it becomes modified in intensity to such a low degree that it is fully adapted to the drying process, which is preliminary to all burning; thus the cost of fuel is brought to a minimum.

At this point it might be well to refer to the manner of building kilns. One of nature's laws is, expansion of all bodies. Therefore when a proposition is made by a professional kiln builder to construct rectangular kilns, with square corners and straight walls along the sides, there should be a danger signal hung out at this juncture. While rectangular kilns are all right, so far as burning is concerned, and where capacity is desired, the difficulty of maintaining straight walls with square corners, and preventing the walls from cracking and bulging, is an expense which no man ought to experience the second time. This can be avoided by building the walls on a slight outward curve, with round corners, and curved walls along the heads of the kilns. When such kilns are properly supported from the outside by efficient truss-work or buttresses, and lined with suitable fire brick, permanency in construction is assured.

When we enter the domain of manipulating clays, we strike a field pregnant with natural laws that must not be ignored. The unpleasant conflict between advocates of soft-mud and stiff-mud processes and the dry-clay promoters of brickmaking has, in a measure, subsided, and there seems to be a calm. Dry process brick machinery has come to stay. Unfortunately, the inventor of this class of machinery has bent his efforts to utilize all kinds of clay in his process. It is a fact that when this system has been adopted, and clay suitably prepared, fairly satisfactory results are acquired, but oftentimes at a much greater expense than it would cost to manufacture brick if the soft-mud process were adopted. A loamy, plastic clay, in low ground that is nearly moist at any and all times of the year, can be moulded into brick and dried as cheaply as clay can be dried sufficiently to mould by the dry-press process. Such material, when it has to be manipulated, ground, screened, tempered, and pressed, and oftentimes dried, before going into the kilns, is, to my mind, a foolish and expensive system.

Then, again, to undertake to work varieties of loamy clay, that make an excellent soft-mud brick, by stiff-mud process, is a violation of the natural law, — an adaptation that nobody ought to undertake to repeat at this late day and age of the world; and so we might refer in detail at such length as would exhaust your patience, and not cover the field that comes before us in these departments. Let danger signals be hung out often, and surround these various difficulties that must be and are daily encountered by the manufacturing fraternity.

There is an old adage, "A hint to the wise is sufficient." The great trouble is, we have to deal with so many people of the opposite character. Wise men are the ones that learn, and generally pay little for experience. Fools learn in no other school, and, as a class, never learn anything. After all dangerous conditions have been avoided, and wisdom, prudence, and judgment displayed in the seclection of clay, machinery, erection of kilns and plant, we are at last in condition to try our luck.

Allow me to condense the foregoing into four propositions, before each of which I wish to warn you of danger: —

1. The selection of a suitable site and clay property.

2. Absolute proof that the machinery which you contemplate using is suitable for such material.

3. The erection of kilns best adapted in shape and design to the burning of your machine products.

4. And most important, can you find a market for the goods? What is your opinion of a capitalist who invested over one million dollars in the manufacture of an end-cut common brick, the market absolutely refusing to receive one fourth of his output, demanding side-cut brick or nothing. I will not ask you to guess as to the result of this enterprise; but one conclusion could be reached.

Does it not occur to you that in this year of our Lord 1895, inasmuch as so many ruts have been travelled over in the developments of this great industry, is it not folly at this late date for others to go on with their ups and downs, successes and failures, operating in the ruts that others have travelled in before for centuries? Every rut that has particular disaster along the line should have its danger signal prominently hung out, and everybody warned of its liability.

The most important subject connected with the cost of manufacturing brick and building material of every description is labor. The erection of numerous clay-working plants for the manufacture of almost everything imaginable has created such competition that success is impossible without the greatest care, and most careful handling of all help employed.

My brother manufacturers should, at this point, plainly observe a prominent danger signal, and it might be well for some of them to invest a small amount in the purchase of short-sight spectacles; then look carefully through the several departments in their works, and determine in how many places two men are doing the work which should be accomplished by one. In many factories I have visited, spectacles would be unnecessary. I believe the bane of all brick manufacturers' existence is the everlasting and never failing to materialize, pay day. The introduction of labor-saving machinery is most essential, and a topic upon which I would gladly dwell if time permitted.

Right here a word of suggestion might not be amiss to the craft, which, in numbers, far exceeds its representatives here in this national association, and in this, I refer to labor organizations, so called, the object being to control prices paid to its members. Whenever it becomes necessary for labor to so organize, and a walking delegate is sent forth to represent the men, should such a delegate trespass upon the ground and through the plant of a brickmaker, let the red light be presented before him at once, and immediately seek, if possible, to bring about such a state of affairs with your workmen as shall disarm this delegate of his power for injury.

There are altogether too many professional men for the laborer to support, and do it without serious embarrassment to his own reserve for a rainy day. Between the preacher and the lawyer, life and accident insurance, etc., expense of maintaining the walking delegate should be eliminated. The average workman is consistent in his request, moderate in his demands, and if the demands are met in the proper spirit, he will seldom cause trouble. It is their business to work; their very existence depends upon it; and since we are all desirous of making our living by the sweat of their brows, due consideration must be given them if satisfactory labor is desired.

Another thing that might not be amiss here is suggested by the memory of an incident that happened only a few years ago to a man who was very prominent as mayor of a large city, and also a manufacturer of brick, who, in the days of his adversity, called in the family physician and requested him to examine his throat. Opening his mouth very wide, the doctor looked in and saw nothing particularly alarming. The patient said, "Look again, I know there is something wrong. I have swallowed a brick yard, machinery and all." This man was in the last stage of delirium, occasioned by the excess of the drink habit; and signals cannot be put out too often, guarding against the danger that the drink habit emphasizes upon manufacturers and workmen.

Such disaster is possible in connection with the manufacture of brick, and in the handling of machinery through the various processes, and the manipulation of clay, drying and setting brick, until the last and most important and most expensive of all, the burning. Whiskey is the poorest way that has ever been tried to open the door of success with brick or any other kilns. Let the red light be hung around the

beer kegs and whiskey bottles, and to emphasize a remark that we remember is attributed to Josh Billings, when speaking of the proper way in which to train children in the way they should go, "It is a very good thing for parents to travel that way themselves once in a while."

Sobriety is absolutely essential to the successful operation of a brick plant. There is a danger more local in its general application than anything previously alluded to, which may be well to mention, and that is the organization of brickmakers' trusts, or combinations, for the purpose of maintaining prices of brick. Those who have had experience along this line know well the dangers that beset the craft. In the average size cities, combinations can be maintained, if properly managed, that will prove beneficial to all concerned, — the builder, the contractor, as well as the manufacturer. The particular danger of combinations of this character, and where, I believe, the red light should be hung out after the combination is completed, and all have entered with good will and purpose, is the danger of putting the price of brick so high as to invite capital to engage in the manufacture, and thus break the combination and force the price of brick to a lower level than it had ever been before.

A law that should not be lost sight of is the law of equilibrium. If prices are made by any combination to go up too high, it is just as certain they will swing down below the line as they have been raised above it. This is not liable if reasonable and fair compensation for the use of capital is obtained. Let the experience of the past be a guide to future operations in this, and be satisfied with a reasonable and fair margin for the use of capital invested, wear and tear of machinery and plant, also the payment of good wages to men who perform the work.

ECHOES FROM THE CONVENTION.

THE man who goes into the brick business now, unless he is too bull-headed to ask advice, need make but few mistakes. — ALSIP.

THE brick business requires for its successful prosecution a high order of ability, including the skill of the engineer, a knowledge of mechanics, and good financial judgment. — ALSIP.

I HAZARD the prediction that in the cities of New York and Chicago (notwithstanding the vigorous opposition of rival paving companies) many of us will live to see granite blocks taken up and replaced by annealed paving brick. — ALSIP.

MEN who have made failures in brick usually attribute such failure to the wrong person or persons. Machine men have been abused, kiln men blamed, manufacturers of all kinds of brickmaking appliances have been execrated, forsooth, because they have sold machinery to some poor innocent, whom Divine Providence had intended to measure tape instead of making brick. — ALSIP.

AMERICA is earning a reputation for beautiful architecture and comfortable homes, and to the American brickmaker belongs much of the glory of wresting from Nature's bosom the materials out of which are constructed our massive temples of trade and commerce, our beautiful homes, our magnificent pantheons to religion, our palaces of art and learning, our mighty structures which challenge and compel the admiration and astonishment of the world. — ALSIP.

THE wise turkey, as it thought it would be, says, "I won't eat anything now. Thanksgiving time is coming on, and the farmer will surely kill you if you are fat, and sell you and take you to market." Well, what appeared to be the foolish turkey went on eating and ate all the good things of life and became fat. So Thanksgiving did come, and the farmer killed both of them, the foolish and the wise turkey, and in the lean turkey he put a rock and made him weigh more than the fat turkey. And the moral of that is, "Don't give up a good thing when you have it." — STORY BY BLAIR.

FIRE losses have been so frequent and disastrous during the past few years that it is almost impossible for brick yards to secure insurance. It would seem that fireproof construction in our business would be the easiest solution of this difficulty in construction of new yards; but for the better protection of old yards, I advise the appointment of a committee to recommend means and appliances for the prevention and putting out of fires in brick yards. — ALSIP.

A SHORT time ago, I wandered into an architect's office in Chicago, and, with that quiet persistence which characterizes some of the citizens of that town, I found my way into his private sanctum, to his private desk. Before sitting down I saw pasted in a conspicuous place on his desk this little announcement, "Don't tell me your troubles, I have got my own," — GATES.

I AM reminded by this, somewhat, of a very estimable old lady I used to know, whose habit it was to go out into the pleasant summer sunshine and gather a bloom which contained within its area an essence, a concentrated concatenation of bitterness, that would turn a strong man's mouth inside out, and spread it all over his face in wrinkly shivers. — GATES.

THEN as the shadows of the night were coming up I saw what promised to be the last of this fleet coming with her little handkerchief of a jib, and watched with bated breath for what we thought could be but another victim, but the watchful eye of the skipper bore witness to a generation of storm fighting ancestors, and his hand faltered not the least bit as, steering just as closely as he could to the lighthouse crowned end of the breakwater, he, peeking his sails the least little bit, and using the force of the storm to guide him, guided his ship up into the mouth of the river and into safety. — GATES.

I SAY you are better men than you would have been without the trials and troubles of the past year, and I greet you as captains who have piloted your ships safe into the harbor in the times that have tried men's souls. — GATES.

I SAY that a hermit who lives alone, cut off in the desert far from all outside influences, never can have that breadth of character that comes to men who are in the race of every day affairs and are continually meeting and conquering temptations. — GATES.

IN the somewhat remote past, in the time of the Roman Empire, there was a large class of people who were all tied up in maritime affairs; they were called galley slaves. — GATES.

NO man, in my opinion, unless he has got the sand and the grit to withstand these storms and these tempests, will endure in any pursuit of life, and it is just as we meet, encounter, and successfully battle with these storms that we feel ourselves strong. — ITTNER.

CLAY workers should read and subscribe for all the clay journals. It takes men of brains now to manufacture brick, and you should keep abreast of the times. There are several good publications, take them all and learn what your contemporaries are doing. The manufacturer of clay, especially brick, should be familiar with literature and art. — BLAIR.

A GOOD burn is "the consummation devoutly to be wished for"; it is the "end all and be all" to a brick dealer. There is hardly any use nowadays for soft or salmon brick; the architects will not have them. I believe they are right, as anybody can burn pale brick, but it takes a skilled workman to make a good hard burn. If the architect holds all parties to the same standard, it will elevate the calling. It is the one who makes the poor quality of goods that cuts the price in order to sell them, and you who make a good article have to reduce the price to the same scale as your competitor. — BLAIR.